CODE: BIOL 101 ***TITLE***: General Biology I

Institute: STEM ***DEPARTMENT***: Biology

COURSE DESCRIPTION: This introductory level course is designed for science majors and for students in other majors that require a laboratory science course. Through exercises in the laboratory and classroom experiences, the student will demonstrate the ability to identify, describe and interpret basic biological concepts. These concepts include the chemical basis of life, levels of organization, photosynthesis, cellular respiration, metabolism, and genetic continuity and heredity. Scientific inquiry utilizing the scientific method is emphasized throughout the course.

PREREQUISITES: HS Biology or a grade of "C" or higher in BIOL 105; HS Chemistry or a grade of "C" or higher in CHEM 100 or CHEM 136; a grade of "C" or higher in MATH 021, MATH 025, or satisfactory completion of the College's foundational studies requirement in algebra; READ 095 or satisfactory completion of the College's foundational studies requirement in reading; ENGL 095 or satisfactory completion of the College's foundational studies requirement inwriting.

PREREQUISITES OR COREQUISITES:

COREQUISITES:

CREDITS: 4 ***LECTURE HOURS***: 3 ***LAB/STUDIO HOURS***: 3

REQUIRED MATERIALS:
BIOLOGY; Neil A. Campbell, JB Reece, LA Urry, ML Cain, SA Wasserman, PV Minorsky, RB Jackson
Eleventh Edition, 2016
Pearson.

ADDITIONAL TIME REQUIREMENTS:
Additional weekly lab time may be required to practice lab skills. (See instructor)

COURSE LEARNING OUTCOMES:

- Demonstrate comprehension and application of basic biological concepts:
  - properties of life
  - chemistry of life
  - cell structure and function
  - photosynthesis, cellular respiration and metabolism
  - genetics and heredity
- Employ the **scientific method** of inquiry to gather and use information for the express purposes of critical thinking, information analysis, and problem solving; (SC)
- Use appropriate technology

Learning Outcome(s) support the following General Education Knowledge Areas:

- (SC) Sciences

GRADING STANDARD:
A student must have an average of 65% or better for the classroom component of the course and an average of 65% or better for the laboratory component of the course in order to earn a final passing grade for the course.
Upon completion of the course, grades will be assigned as follows:

A = 92 – 100%
A- = 89 - 91%
B+ = 86 - 88%
B = 82 - 85%
B- = 79 - 81%
C+ = 76 - 78%
C = 70 - 75%
D = 65 - 69%
F = <65%

Unit examination results will be reported as the grade assigned by the faculty calculated to the first decimal place. These grades will be weighed according to course grading policy. In calculating the course grade, 0.5 will round up to the next numerical grade and 0.4 will round down to the next lower numerical grade.

A grade of C or better is required in all pre-requisite courses. Career studies courses must have a grade of C or better to count toward the Mathematics / Science Program – Biology Option.
Students are permitted to withdraw from the course without penalty until approximately 80% of the semester is complete. Please see term schedule for the exact deadline.

At the end of the semester, application for an Incomplete may be made if a student with proper documentation needs to complete no more than one lecture exam and/or one laboratory practical. The granting of an Incomplete is at the discretion of the instructor.

COURSE CONTENT:
Unit One: Introduction and Philosophy of Life Sciences
Unit Two: Chemistry of Life – An Introduction
Unit Three: Cell Structure and Function
Unit Four: Cellular Respiration and Photosynthesis
Unit Five: Principles of Heredity
Unit Six: Human Genetics
Unit Seven: Nucleic Acids – Protein Synthesis

DEPARTMENT POLICIES:
Attendance during class and laboratory sessions is strongly recommended for optimum performance in biology courses.
Laboratory practicals will be given during laboratory sessions, in accordance with schedules provided by the learning assistants. Exams and practicals must be taken at the times designated by the instructor or learning assistant. A student who misses a lecture exam or laboratory practical must provide prior notification and proper documentation in order to take the exam or laboratory practical. The acceptance of said prior notification and proper documentation will be determined by the instructor.
Documentation must be provided within one week of the student's return to the classroom for a make-up exam or laboratory practical to be scheduled. A student who is unable to provide proper documentation for a missed exam or laboratory practical will be given a grade of zero for that exercise. Students may not re-take exams or laboratory practicals on which they perform poorly.
Requirements for the completion of laboratory are listed in the laboratory responsibility sheets provided by the learning assistant. Requirements for course completion are listed in individual instructor syllabi.

COLLEGE POLICIES:

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit www.brookdalecc.edu/support

Please refer to the STUDENT HANDBOOK AND BCC CATALOG for information regarding Brookdale's:

- Academic Integrity Code
- Student Conduct Code
- Student Grade Appeal Process

Please refer to the **STUDENT HANDBOOK AND BCC CATALOG.**

***NOTIFICATION FOR STUDENTS WITH DISABILITIES*:**

Brookdale Community College offers reasonable accommodations and/or services to persons withdisabilities. Students with disabilities who wish to self-identify, must contact the Disabilities Services Office at 732-224-2730 or 732-842-4211 (TTY), provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved.

ADDITIONAL SUPPORT/LABS:

Course Website:

Biology Department information and BIOL 101 resources are available on the Brookdale website: https://www.brookdalecc.edu/stem-institute/biology/

BIOL 101	General Biology I	# 1 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **INTRODUCTION AND PHILOSOPHY OF LIFE SCIENCES**

Unit Objective: Describe the philosophy of science, discuss the characteristics that distinguish living from the non-living and list and briefly describe the levels of organization. Demonstrate an ability to use three "biological tools": scientific problem solving, the compound microscope, and the dissection microscope. Demonstrate an understanding of the significance of the investigation of lifephenomena.

Textbook: BIOLOGY by Campbell et.al., 11th edition - Chapter 1

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: One Week

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Identify aims as well as limitations of science.	pages 16-24
2. Define the scientific method as a process and list in sequence the probable steps of this procedure. Utilize a scientific approach to problem solving, by successfully applying this approach to the solution of a hypothetical problem provided by your instructor.	pages 16-24
3. List and briefly describe at least five characteristics that distinguish living organisms from non-living things.	pages 2-3; Figure 1.2
4. Compare and contrast the living and non-living characteristics of a virus and relate to the definition of "life".	pages 396-400
5. List and define each of the levels of organ-ization (hierarchy of levels). Explain the relationship of the number of units, size of each unit, complexity, energy requirements, order and stability changes as one progresses from the level of sub-atomic particles to the biosphere, from the non-living to the living.	pages 4-5; Figure 1.3
6. Name and distinguish the five kingdoms within the biological system of classification. These taxonomic groups are useful in understanding unity and diversity of life forms.	pages 12-14; Figures 1.13, 1.14
7. Successfully complete assigned laboratory experiences.	

BIOL 101	General Biology I	# 2 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **CHEMISTRY OF LIFE - AN INTRODUCTION**

Unit Objective: Understand the basic concepts of chemistry that are related directly to the function of the cell as a living system. Identify the structure and function of macromolecules common to all organisms and thechemical processes of synthesis and dehydration utilized to synthesize and decompose these complex molecules.

Textbook: BIOLOGY by Campbell et.al., 11th edition - Chapters 2 - 5

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: Two Weeks

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Define matter. Discuss the role of protons, neutrons and electrons in the atom, the fundamental unit of all matter. Include a comparison of the mass, charge and location of each subatomic particle.	pages 30-36; Figure 2.4
2. Differentiate between weight and mass.	page 31
3. Define and differentiate the terms: electron shell, energy level & orbital.	pages 32-36; Figure 2.6 – 2.8
4. Define valence electrons and calculate the number of electrons in the valence shells of the biologically significant atoms.	pages 34-35; Figure 2.9
5. Compare and contrast an atom with an ion, element, and isotope.	pages 29-31 & 40
6. Using the periodic table, determine atomic number, atomic mass, and numbers of sub-atomic particles in one atom of a given element.	pages 31-35; Appendix B; Figure 2.7
7. Compare and contrast ionic, covalent, polar covalent, and hydrogen bonding inmolecules using examples and stating the biological significance of each type of bond.	pages 36-39; Figures 2.9 - 2.14, 3.2
8. Describe and provide examples of properties of and different types of chemical reactions.	pages 40-41, 66-70; Figure 5.2
9. Describe the characteristics of water and state the significance of water to living organisms.	pages 44-50; Figures 3.2 - 3.8.
10. Define pH; describe how it is measured and cite examples of substances which act as acids and others which act as bases. Identify and discuss the role of buffers.	pages 51-53; Figures3.11& 3.12

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
11. Define the following terms and state how they are related: chemical formula, structural formula and isomer.	pages 58-62; Figures 4.3 – 4.8
12. Identify and describe the structure, functional groups (identifying subunits) and chemical bonds found in the four basic types of biological macromolecules.	pages 62-64; Figure 4.9
13. Distinguish between dehydration (condensation) and hydrolysis reactions and state their roles in altering the structure of organic molecules.	pages 66-67; Figure 5.2
14. Describe the structure and function of simple and complex carbohydrates, giving examples of biologically important molecules.	pages 68-72; Figures 5.3 – 5.8
15. Describe the structure and function of various types of biologically important lipids.	pages 72-75; Figures 5.9 – 5.12
16. Describe the structure and function of biologically h . important proteins.	pages 75-83; Figures 5.14 – 5.20
17. Describe the primary, secondary, tertiary, and quaternary structure of proteins. Cite examples of each, state cellular functions and discuss their relative levels of stability.	pages 79-83; Figures 5.18 – 5.21
18. Describe the role of enzymes as catalysts for chemical reactions in the cell.	pages 78-79; Figure 5.16
19. Describe structures and functions of nucleic acids.	pages 84-87; Figures 5.22 – 5.26
20. Describe the structure of ATP and discuss its role source of chemical energy in the cell. pages151; Figure 8.9	
21. Successfully complete assigned laboratory experiences.	

BIOL 101 General Biology I # 3 of 7 Units 4
Course No. Title Credits

Name of Unit: **CELL STRUCTURE AND FUNCTION**

Unit Objective: Identify and describe the structures and functions of the parts of a typical animal cell and a typical plant cell. Identify specific types of plant and animal cells and relate their functions and/or behaviors to their structural variations. Discuss the process of cell division. Describe the role of cell division in asexual reproduction and organismic growth and repair.

Textbook: BIOLOGY by Campbell et.al.,11th edition - Chapters 1, 6, 7 & 12

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: Two Weeks

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Describe the cell theory. Discuss the importance of the microscope in the study of cell structure and cell fractionation in the study of cell function.	pages 6, 94-97, Figures 6.2 – 6.4
2. Distinguish between prokaryotic and eukaryotic cells.	pages 8, 97-101; Figures 1.4, 6.5
3. Describe the various proposed models of cellular membranes, their locations, probable origin and functions.	pages 97- 98, 127– 132; Figures 6.6, 7.2 – 7.7
4. Define and explain the roles of diffusion, osmosis, facilitated diffusion, and active transport in the movement of materials through cell membranes using the terms: hypotonic, hypertonic, isotonic and plasmolysis.	pages 131 – 139; Figures 7.10 – 7.18
5. Locate the following structures on a cell model, diagram or electron micrograph: basal body plasma membrane cell wall centriole centrosome centromere chloroplast chromatin chromosome chromatid cristae cilia & flagella cytoplasm cytoskeleton desmosomes endoplasmic reticulum gap junction Golgi complex grana lysosome mitochondria nuclear envelope nucleolus nucleoplasm nucleus peroxisome plasmodesmata pseudopodia ribosomes stroma tight junction vacuoles	pages 99 – 125; Observe electron photomicrographs and drawings of cell structures - pages 95-121 Compare plant and animal cell models on display in the lab (and Figure 6.8).

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
6. State the functions of the preceding cell structures or organelles.	pages 99-125
7. Compare and contrast the structures of a "typical" plant and animal cell as to their component parts.	pages 100-101; Figure 6.8
8. Compare endocytosis and exocytosis. Define and explain the role of pinocytosis, phagocytosis, and receptor mediated endocytosis in terms of vesicle formation.	pages 139-141; Figure 7.19
9. State the significance of the cell cycle as it applies to asexual reproduction, growth and repair.	page 234; Figure 12.6
10. Identify the role of cellular structures involved in mitosis: chromosomes, chromatids, centromeres, centrioles, asters, kinetochores and spindle fibers .	pages 234-241; Figures 12.3-12.5, 2.7-2.9,12.11
11. Describe the significant steps in the process of cell division: interphase (G_1, S, and G_2 phases), mitosis (prophase, metaphase, anaphase,telophase) and cytokinesis, (cleavage furrow, cell plate) in both plant and animal cells.	pages 237-243; Figures 12.5 – 12.11
12. Briefly describe regulation of the cell cycle.	pages 244-249; Figures 12.14 – 12.20
13. Successfully complete assigned laboratory experiences.	

BIOL 101	General Biology I	# 4 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **CELLULAR RESPIRATION AND PHOTOSYNTHESIS**

Unit Objective: Discuss and diagram the events that occur during aerobic and anaerobic cellular respiration as means of producing usable energy in the form of ATP. Describe and/or diagram aerobic and anaerobic respiration and photosynthetic processes (photophosphorylation and the Calvin Cycle). Include required conditions, site of activity, raw materials, products formed, relative efficiency and overall importance in producer organisms where applicable.

Textbook: BIOLOGY by Campbell et.al., 11th edition - Chapters 8, 9 & 10

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: Two Weeks

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Define reaction, catalyst, enzyme, substrate, active site, and energy of activation. Relate these terms to the theory of enzyme action.	pages 153-156; Figures 8.13 – 8.16
2. Define competitive, non-competitive and irreversible inhibition; state methods of action and biological significances of chemical reactions.	pages 157-159; Figures 8.18
3. Explain the inter-relationships of the energy of activation, free energy, pressure, temperature and concentration on the rate of cellular chemical reactions which involve oxidation and reduction.	pages 153 – 158; Figures 8.13, 8.14,8.16, 9.3
4. State the relationship of free energy change (endergonic and exergonic reactions) and the laws of thermodynamics to synthesis and decomposition of glucose and ATP.	pages 143 – 151; Figures 8.2 – 8.9
5. Discuss the importance of phosphorylation reactions as the key to understanding the role of ATP as a universal energy source.	pages 150-152; Figures 8.9 – 8.11
6. State the significance of cellular respiration and cite examples of organisms using aerobic and anaerobic respiration.	pages 164-166, 177-178; Figures 9.16, 9.19
7. Summarize the process of glycolysis and state its relationship to fermentation, lactic acid synthesis and aerobic respiration.	pages 168-170; Figures 9.6, 9.8, 9.9, 9.17
8. Compare and contrast alcohol fermentation and lactic acid synthesis to include the products formed, site of activity, and the conditions under	page 179-181; Figures 9.17, 9.18

which each will occur.

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
9. Diagram and indicate the inter-relationships between the major reactions of glycolysis, the bridge reaction, the Kreb Cycle, electron transport system, and oxidative phosphorylation to include the sites of activity and final end products.	pages 168-178; Figure 9.6 – 9.16
10. Identify the sources and respective numbers of ATP molecules produced during the complete aerobic oxidation of glucose to carbon dioxide and water and the possible uses of these ATP molecules.	pages 174-178; Figures 9.15, 9.16
11. Briefly describe the chemiosmotic theory as a process which enables mitochondria to produce ATP.	pages 175-178; Figures 9.13 – 9.16
12. Describe various mechanisms of control of cellular respiration.	page 182; Figure 9.20
13. Identify how and where lipids and proteins may enter the overall process of cellular respiration.	pages 181 – 183; Figure 9.19
14. Compare and contrast the overall summary equations for photosynthesis and respiration.	pages 166, 191
15. Describe the internal structure of the chloroplast.	page 189 – 190; Figures 10.4
16. Compare reflected, transmitted and absorbed light with regard to its influence on photo-synthesis and the coloration of leaves.	pages 192-194; Figure 10.8
17. State the relationship of light wavelength and energy to the absorption spectrum of chlorophyll and to the action spectrum of photosynthesis.	pages 192-195; Figures 10.7-10.12
18. Diagram and explain the steps and products formed as a result of photosystems I & II.	pages 195-198; Figures 10.13 – 10.15
19. Explain the mechanism and significance of cyclic electron flow.	page 198; Figure 10.16
20. Diagram and discuss the Calvin Cycle to include the raw materials and end products.	pages 201-202; Figure 10.19
21. Describe the main function of photosynthesis using the following terms: light energy, chlorophyll, accessory pigments, photophos-phorylation, coenzyme, ATP and G3P.	pages 187 - 202; Review Figure 10.22

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
22. Describe the alternate mechanism of carbon fixation in C_4 plants.	pages 203-206; Figures 10.20, 10.21
23. Successfully complete assigned laboratory experiences.	

BIOL 101	General Biology I	# 5 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **PRINCIPLES OF HEREDITY**

Unit Objective: Demonstrate an understanding of the transmission and expression of hereditary information from generation to generation based on the conclusions of Gregor Mendel's experiments. Discuss the processes involved in sexual and asexual reproduction, and the advantages and disadvantages of both.

Textbook: BIOLOGY by Campbell et.al., 11th edition - Chapters 12, 13, 14 & 15

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: Two Weeks

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. State the advantages and disadvantages of both sexual and asexual reproduction.	Pages 255,257-259
2. Review the stages of the cell cycle and significant events occurring in each stage.	pages 235 – 242
3. Compare and contrast the outcome of mitosis to that of meiosis.	pages 262-264; Figure 13.10
4. Describe the process of meiosis (gametogenesis).	pages 259-262; Figures 13.6 – 13.9
5. Define the following terms: hermaphroditism self-pollination parthenogenesis genetics heredity somatic cells gametes parental generation (P) first filial generation (F_1) second filial generation (F_2) autosomes and sex chromosomes gene allele dominance recessiveness homozygous heterozygous phenotype genotype	Glossary and Chapters 13 & 14
6. Explain the results of Mendel's experiments involving pea plants and discuss his laws of segregation and independent assortment using crosses to illustrate these concepts.	pages 269-278; Figures 14.2 – 14.9;
7. Cite examples and genetic crosses involving complete dominance, incomplete dominance, sex-linkage, multiple alleles, epistasis, polygenic inheritance and test crosses.	pages 270-282 Figures 14.5, 14.10 – 14.13
8. Briefly describe techniques and applications of karyotyping, amniocentesis, and chorionic villi sampling in fetal testing for genetic abnormalities.	pages 288-290; Figures 14.19

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
9. Define chromosome mapping, know how maps are developed, and state the significance of gene linkage and crossing over to mapping.	pages 301-306 Figures 15.10 – 15.12
10. Describe the difference in the expression of visible traits according to the particular pattern of inheritance and the effects that genes have on each other and cellmetabolism.	Chapters 14 & 15
11. Successfully complete the assigned laboratory experiences.	

BIOL 101	General Biology I	# 6 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **HUMAN GENETICS**

Unit Objective: Describe and compare the types of mutations resulting from chromosomal changes in humans to indicate the patterns of transmission and the possible changes in phenotype (genetic disorders).

Textbook: BIOLOGY by Campbell et. al., 11th edition - Chapters 13, 15, 17, 20, 21

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: One Week

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Describe a gene and its relationship to a chromosome.	pages 255, page 335
2. Define mutation, cite examples of mutagens and state the relationship of mutations to the process of evolution.	pages 357-360 Figures 17.26, 17.27
3. Recall the importance of somatic and sex chromosomal mutations; state the relative advantages and disadvantages of mutation.	pages 306-309; Figures 15.13 – 15.16
4. Compare and contrast point and chromosomal mutations and cite types of abnormalities which can result.	pages 357-360 Figures 15.13 – 15.16, 17.26 –17.27
5. Relate sex linkage to humans using crosses to illustrate its importance in the transmission of abnormalities.	pages 310-311 Figure 15.7
6. Define aneuploidy. Describe nondisjunction. Describe the effects of aneuploidy in humans.	pages 307-300
7. Briefly describe how genes can be analyzed and manipulated. Identify several practical applications of recombinant DNA technology.	pages 413 – 436
8. Discuss important goals and potential applications of the Human Genome Project.	pages 440 – 446
9. Successfully complete the assigned laboratory experiences.	

BIOL 101	General Biology I	# 7 of 7 Units	4
Course No.	Title		Credits

Name of Unit: **NUCLEIC ACIDS - PROTEIN SYNTHESIS**

Unit Objective: Identify and discuss the basic structures of nucleic acids and the functions each performs in the life and reproduction of cells.

Textbook: BIOLOGY by Campbell et. al., 11th edition - Chapters 5,16,17 & 18

Method of Evaluation: Unit Test and Lab Practical

Estimated Time To Achieve: Two Weeks

Learning Objectives	Recommended Learning Experiences
The Student Will Be Able To:	Class Discussion Textbook Readings:
1. Compare and contrast the nucleotides present in DNA and RNA. Indicate which nitrogen bases are purines and which are pyrimidines	pages 84 – 86, 317 – 320; Figures 5.23 – 5.24, 16.5 – 16.8
2. Demonstrate an understanding of the structure of DNA by properly labeling a diagram or describing its molecular structure and bonding.	pages 84 – 86, 317 – 320; Figures 16.5,16.8
3. Describe the process of DNA replication and state its significance to the mitotic process.	pages 317 – 326; Figures 16.9 – 16.18
4. Describe the processes of transcription and translation, including the roles of DNA, messenger RNA, transfer RNA and ribosomal RNA.	pages 338 – 356; Figures 17.4 – 17.25
5. Explain how various combinations of the four nucleotides of DNA can ultimately code for thousands of different proteins.	pages 341 – 344; Figures 17.5, 17.6
6. Discuss the operon hypothesis and indicate its significance to the further understanding of cellular functions.	pages 364-367; Figures 18.2 – 18.5
7. Compare eukaryotic chromosomes with those of prokaryotes.	pages 330 – 332; Figure 16.22
8. Successfully complete assigned laboratory experiences.	

The syllabus is intended to give student guidance in what may be covered during the semester and will be followed as closely as possible. However, the faculty member reserves the right to modify, supplement, and make changes as the need arises.