BROOKDALE COMMUNITY COLLEGE

Biology 105 Syllabus
Life Sciences

BROOKDALE
COMMUNITY COLLEGE

CODE: BIOL 105 ***TITLE***: Life Sciences

INSTITUTE: STEM ***DEPARTMENT***: Biology

COURSE DESCRIPTION: This course is intended to meet a laboratory science requirement for the non-science major. Through laboratory exercises and classroom experiences the student will demonstrate an appreciation of life phenomena and the diversity of living organisms. Topics include basic metabolic functions that create and sustain life, reproduction, growth, development behavior and adoption of selected life forms and the interactions among living organisms.

PREREQUISITES: A grade of "C" or higher in MATH 012, MATH 015 or passing score in computation on Basic Skills Test and READ 095 or passing score on reading on Basic Skills Test, ENGL 095 or passing score in writing on Basic Skills test

PREREQUISITES OR COREQUISITES:

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

REQUIRED MATERIALS:

Concepts of Biology- OpenStax College, Rice University, 2013.
https://openstax.org/details/concepts-biology

Laboratory Manual: Life Sciences – BIOL 105

ADDITIONAL TIME REQUIREMENTS:
Additional weekly lab time is required.

COURSE LEARNING OUTCOMES;
The student will be able to:

- Demonstrate application of basic biological concepts:
  - properties of life
  - chemistry of life
  - cell structure & function
  - reproduction and genetics
  - evolution and diversity
- Use the scientific method of inquiry to explore biological phenomena.
- Employ appropriate technology and resources to collect and interpret biological information and data.

COURSE CONTENT:
UNIT ONE: INTRODUCTION TO LIFE SCIENCES
UNIT TWO: CHEMICAL BASIS OF LIFE
UNIT THREE: CELLULAR BASIS OF LIFE
UNIT FOUR: CELLULAR RESPIRATION AND PHOTOSYNTHESIS
UNIT FIVE: REPRODUCTION AND GENETICS
UNIT SIX: DNA STRUCTURE, FUNCTION AND PROTEIN SYNTHESIS
UNIT SEVEN: EVOLUTION AND DIVERSITY

GRADING STANDARD:
A student must have an average of 65% or higher for the classroom component and an average of 65% or higher for the laboratory component of the course in order to earn a 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%

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 higher is required in all pre-requisite courses. Career studies courses must have a grade of C or higher 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. Please see Instructor's syllabus for additional policies.

DEPARTMENT POLICIES:
Attendance and active participation during class and laboratory sessions are strongly recommended for optimum performance in biology courses.
Laboratory practical exams will be given during laboratory sessions, in accordance with schedules provided by the laboratory instructors. Exams and practical exams must be taken at the times designated by the instructor or laboratory instructor. 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 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 practical exams on which they perform poorly.
Requirements for the completion of laboratory are listed in the laboratory responsibility sheet. Requirements for course completion are listed in individual instructor syllabi.

COLLEGE POLICIES:
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 with disabilities. 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:

BIOL 105 course and laboratory resources are available in Canvas, Brookdale's Learning Management System, available via the Brookdale website: www.brookdalecc.edu

Independent Study Laboratory (Open Lab) - MAS 041 - is available to students enrolled in biology courses. Students use this lab to complete laboratory exercises, review lab materials, and to get help with course material from laboratory instructors that staff the lab.

Brookdale Biology Department course and program information is available on the Biology Department website:
https://www.brookdalecc.edu/stem-institute/biology/

BIOL 105 LIFE SCIENCES #1 OF 7 Units 4 credits

Name of Unit: **Introduction to Life Sciences**

Textbook: Chapter 1

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	**Textbook Readings:**
The student will be able to:	Chapter 1, section:
1. List and describe the characteristics of living organisms (properties of life).	1.1
2. Describe life's hierarchy of levels of organization.	1.1
3. Identify the biological system of classification, describing the grouping of organisms into three domains and multiple kingdoms.	1.1
4. Describe branches and sub-disciplines of biology.	1.1
5. Describe how a scientist would investigate a problem using the scientific method.	1.2
6. Successfully complete assigned laboratory experiences: • Microscopy	Laboratory manual – Lab Exercise #1

BIOL 105 **LIFE SCIENCES** **#2 OF 7 Units** **4 credits**

Name of Unit: **Chemical Basis of Life**

Textbook: Chapter 2

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	**Textbook Readings:**
The student will be able to:	Chapter 2, section:
1. Define the following terms: • subatomic particles • atom • atomic number • atomic mass • valence • orbital • element • molecule • compound • matter – 3 states • isotope • ion	2.1
2. Use the periodic table to determine atomic number and atomic mass for the following atoms: carbon, hydrogen, nitrogen and oxygen Draw the atomic structure for each.	2.1 & A-1 (Appendix 1)
3. Describe the following chemical bonds and give an example of a molecule where each is found: • hydrogen bond • ionic bond • covalent bonds	2.1
4. Describe the properties of water and their importance to biological systems. • Temperature stability • Polarity • Cohesion and Adhesion • Solvent properties • Density	2.2
5. Define acids and bases and give examples for each.	2.2
6. Define pH and draw a simple pH scale indicating the range for acid and basic solutions.	2.2

BIOL 105	LIFE SCIENCES	#2 OF 7 Units	4 credits

Learning Objectives:	Textbook Readings:
	Chapter 2, section:
7. Describe the role of buffers in biological systems.	2.2
8. Demonstrate an understanding of chemical reactions.	2.3
9. Describe the role of carbon in biological molecules and distinguish between organic and inorganic molecules.	2.3
10. Define functional groups and describe their importance in macromolecules.	2.3
11. Define: • macromolecules • monomers • polymers • dehydration synthesis and hydrolysis reactions.	2.3
12. Demonstrate an understanding of the structures and functions of the four major types of macromolecules: • carbohydrates • lipids • proteins • nucleic acids.	2.3
13. Successfully complete assigned laboratory experiences: • Measurement • Chemical Composition of Cells	 Laboratory manual – Lab Exercise #2 Laboratory manual – Lab Exercise #3

BIOL 105 **LIFE SCIENCES** **#3 OF 7 Units** **4 credits**

Name of Unit: **Cellular Basis of Life**

Textbook: Chapters 3 & 6

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	**Textbook Readings:**
The student will be able to:	Chapter 3, section:
1. Describe The Cell Theory.	3.1
2. Compare light and electron microscopes and discuss their use in studying cell size, shape and complexity.	3.1
3. Describe the differences between eukaryotic and prokaryotic cells.	3.2
4. Compare the relative sizes of plant, animal and bacterial cells.	3.2
5. Define the term "organelle". Identify and describe the structure and function of the following in eukaryotes: • Nucleus Nucleolus, Chromatin, Nuclear envelope, Nuclear pore • Ribosome • Endoplasmic reticulum – rough and smooth • Golgi apparatus • Lysosome • Vacuoles – Central Vacuole • Mitochondria • Chloroplast • Cytoskeleton Microtubules, Intermediate filaments, Microfilaments • Centrioles - Centrosome • Flagella and Cilia • Plasma membrane • Cell wall	3.3
6. Describe the "Fluid Mosaic Model" of the plasma membrane.	3.4
7. List and describe the components of the plasma membrane: • Phospholipids • Cholesterol • Proteins • Carbohydrates	3.4

Learning Objectives:	**Textbook Readings:**
	Chapter 3, section:
8. Describe the following transport processes: • Passive o Diffusion o Facilitated diffusion o Osmosis • Active o Active transport o Endocytosis o Exocytosis	3.5
9. Use the following terms to describe transport processes: • solute • solvent • concentration gradient • tonicity (hypertonic, hypotonic, and isotonic) • lysis • crenation • plasmolysis • turgor pressure	3.5
	Chapter 6, section:
10. Describe the purposes of cell division.	Introduction
11. Describe the stages of the cell cycle: • Interphase (G_1,S,G_2) • Mitotic phase (Mitosis and Cytokinesis)	6.2
12. Describe the chromosome and its structures: • centromere • chromatid • kinetochore • homologous chromosomes	6.1 & 6.2
13. Describe the stages of mitosis: • Prophase • Metaphase • Anaphase • Telophase	6.2
14. Describe cytokinesis in animal cells and plant cells to include: • cleavage furrow formation • cell plate formation	6.2
15. Describe cell cycle control systems and the relevancy of uncontrolled growth in cancer cells.	6.3

BIOL 105	LIFE SCIENCES	#3 OF 7 Units	4 credits

Learning Objectives:	Textbook Readings:

16. Successfully complete assigned laboratory experiences:

• Cell Structure and Function	Laboratory manual – Exercise #4
• Diffusion and Osmosis	Laboratory manual – Exercise #5
• Cell Division	Laboratory manual – Exercise #6

BIOL 105 **LIFE SCIENCES** **#4 OF 7 Units** **4 credits**

Name of Unit: **Cellular Respiration and Photosynthesis**

Textbook: Chapters 4 & 5

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives	Textbook Readings:
The student will be able to:	
	Chapter 4, section:
1. Discuss the Laws of Thermodynamics and how energy is converted through biological systems.	4.1
2. Define metabolism: • Endergonic (anabolic) reactions • Exergonic (catabolic) reactions	4.1
3. Describe the structure and functions of enzymes using the following terms: • Activation energy • Active site • Co-enzymes • Denaturation • Enzyme inhibitors • Substrate	4.1
4. State the structure and role of ATP in the cell.	4.2
5. Describe the process of and summary equation for cellular respiration.	Introduction & Class discussion (also see section 5.3)
6. Describe the major pathways used in the process of cellular respiration: • Glycolysis • Bridge reaction • Citric Acid Cycle • Oxidative Phosphorylation & Electron Transport Chain	4.2 & 4.3
7. Compare and contrast aerobic respiration with fermentation.	4.4
8. Discuss the importance of carbohydrate, lipid and protein breakdown and how these molecules are utilized in aerobic respiration.	4.4
	Chapter 5, section:
9. Describe the process of and summary equation for photosynthesis.	5.1 & 5.3
10. Discuss the importance of photoautotrophs as producers.	5.1

BIOL 105 LIFE SCIENCES #4 OF 7 Units 4 credits

Learning Objectives:	Textbook Readings:
	Chapter 5, section:
11. Describe the basic structure of a leaf and its component parts: • Epidermal layers – stomata and guard cells • Mesophyll layers – palisade and spongy • Vascular tissue – xylem and phloem	5.1
12. Describe the basic structure of a chloroplast: • Granum • Thylakoid • Stroma	5.1
13. Describe the electromagnetic spectrum and the significance of visible light as an energy source for photosynthesis.	5.2
14. Describe the two stages of photosynthesis, including the location, raw materials and products of each: • Light Reactions • Calvin Cycle	5.2 & 5.3
15. Describe the interrelationship between the Light Reactions and the Calvin Cycle.	5.2 & 5.3
16. Discuss adaptations as they relate to photosynthesis in plants in different environments.	Evolution in Action -Chapter 5
17. Summarize and compare the processes of aerobic cellular respiration and photosynthesis to include locations, raw materials and products.	The Energy Cycle 5.3
18. Discuss the greenhouse gases, the greenhouse effect and climate change.	Class discussion
19. Successfully complete assigned laboratory experiences: • Enzymes • Photosynthesis	 Laboratory manual – Lab Exercise #7 Laboratory manual – Lab Exercise #8

BIOL 105 LIFE SCIENCES #5 OF 7 Units 4 credits

Name of Unit: **Reproduction and Genetics**

Textbook: Chapters 6, 7 & 8

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	Textbook Readings:
The student will be able to:	
1. Define asexual reproduction. Describe the following types of asexual reproduction: • Binary fission • Budding • Fragmentation • Parthenogenesis	Chapter 6, section: 6.4, (also sections 15.2 & 18.1)
2. Define sexual reproduction. Briefly describe the stages of sexual reproduction: • Meiosis & Fertilization	Chapter 7, section: 7.1, (also see section 18.1)
3. Compare and contrast sexual and asexual reproduction.	7.1
4. Describe meiosis and the following terms/concepts: • haploid & diploid • gamete & somatic cell	7.1 & 7.2
5. Explain how fertilization restores the diploid number in offspring during sexual reproduction.	7.2
6. Explain how sexual reproduction produces genetic variation in offspring: • crossing over • independent assortment • random fertilization	7.2
7. Describe Gregor Mendel's contributions to the study of genetics: • Law of Segregation • Law of Independent Assortment	Chapter 8, section: 8.2
8. Relate the following terms to Mendelian Genetics: • gene • alleles • locus • genotype & phenotype • homozygous/heterozygous • dominant/recessive	8.1 & 8.2 & Key terms Chapters 6, 7 & 8

Learning Objectives:	Textbook Readings:

8. Relate the following terms to Mendelian Genetics (cont'd):
   - traits and characters
   - monohybrid and dihybrid
   - cross fertilization
   - homologous chromosomes

9. Follow Mendelian principles to perform Punnett square analyses to predict the results of monohybrid and dihybrid crosses in Mendel's pea plants. — 8.2

10. Discuss the use of a testcross to determine an unknown genotype. — 8.2

11. Describe extensions of Mendelian genetics: — 8.3
    - incomplete dominance
    - codominance
    - polygenic inheritance
    - pleiotrophy
    - epistasis
    - multiple alleles
    - gene linkage
    - sex linkage

12. Explain the chromosomal theory of inheritance. Include a description of a karyotype. — Chapter 7, section 7.3

13. Describe and give examples of abnormalities in chromosome structure and number: — Chapter 7, section 7.3
    - deletion, duplication, translocation, inversion
    - aneuploidy due to nondisjunction:
      -monosomy and trisomy:
        - Down Syndrome
        - Turner Syndrome
        - Klinefelter Syndrome
        - XYY
        - XXX

14. Describe and give examples of autosomal dominant and recessive inheritance. — Chapter 8, section 8.2

15. Describe a pedigree and apply it to various examples of human genetic disorders. — Class discussion

16. Successfully complete assigned laboratory experiences:
    - Reproduction — Laboratory manual – Lab Exercise #9
    - Genetics — Laboratory manual – Lab Exercise #10

BIOL 105 LIFE SCIENCES #6 OF 7 Units 4 credits

Name of Unit: **DNA Structure, Function and Protein Synthesis**

Textbook: Chapters 9 & 10

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	**Textbook Readings:**
The student will be able to:	
1. Describe important scientific events leading to the discovery of the DNA molecule and as the genetic material in living organisms.	Chapter 9, section: 9.1
2. Review the structure of DNA.	9.1
3. Demonstrate an understanding of the process of DNA replication.	9.2
4. Describe the process of protein synthesis: • Transcription • Translation	9.3 & 9.4
5. Describe the events of transcription to include the following: • DNA template strand • triplet • RNA polymerase • mRNA • codon	9.3
6. Describe the events of translation to include the following: • mRNA • ribosome • tRNA • anticodon • amino acids • polypeptide	9.4
7. Given the sequence of nucleotides on the template strand of DNA, use the master genetic code to determine the correct amino acid sequence in a polypeptide.	9.4 (Figure 9.20)
8. Describe the impact of the following mutations on protein synthesis: • point (nucleotide (base) substitution) • frameshift (nucleotide (base) insertion or deletion)	Class discussion
9. Discuss regulation of genes in prokaryotes and eukaryotes.	9.5

BIOL 105 **LIFE SCIENCES** **#7 OF 7 Units 4 credits**

Name of Unit: **Evolution and Diversity**

Textbook: Chapters 11, 12, 13, 14 & 15

Method of Evaluation: Exams, quizzes, assignments, laboratory exercises and practical exams

Recommended Learning Experiences: Class discussion and assignments, textbook readings, laboratory exercises

Learning Objectives:	**Textbook Readings:**
The student will be able to:	
1. Review Natural Selection as the mechanism of evolution. Cite evidence that supports the Theory of Evolution.	Chapter 11, section: 11.1, 11.3 & 11.5
2. Demonstrate an understanding of a general geologic time scale, focusing on the following: • origin of the earth • evolution of the prokaryotes • evolution of the first eukaryotes • oxygen accumulation in the atmosphere • evolution of the first animals • evolution of the land plants	Class discussion
3. Review the biological system of classification, describing the grouping of organisms into three domains and kingdoms.	Chapter 12, section 12.1: (Review Chapter 1, section 1.1)
4. List the categories of classification from most general to most specific.	Chapter 12, section 2.1
5. Describe prokaryotic diversity and the significance of prokaryotes on the earth.	Chapter 13, section 13.1
6. Demonstrate an understanding of the evolution of early eukaryotes on the earth.	13.2
7. Describe diversity and significance of the protists.	13.3
8. Describe diversity and significance of the fungi.	13.4
9. Describe diversity and significance of the plants.	Chapter 14, section 14.1-14.4
10. Describe the basic characteristics of animals, focusing on the differences between invertebrates and vertebrates.	Chapter 15, section 15.1 & 15.6

11. Successfully complete assigned laboratory experiences: • Diversity of Life I • Diversity of Life II	Laboratory manual – Lab Exercise #11 Laboratory manual – Lab Exercise #12