# COURSE OUTLINE

| Course Number | Course Title | Credits |
|---|---|---|
| **BIO 101** | **General Biology I** | **4** |

**Hours: 3/3 Lecture/Lab**

**Prerequisites**
High School Biology or BIO 100
MAT 038 or MAT 044

**Co-requisites:**
BIO 101 Lab, ENG101

**Implementation Semester & Year**

**Spring 2022**

**Catalog description:**

Introduces fundamental concepts and principles of biology. Topics include biological chemistry, cell biology, metabolism and energy, cell reproduction, molecular biology, and inheritance. Investigative laboratory exercises develop skills in basic techniques and reinforce lecture material. The course is intended for science majors.

**General Education Category:**
**Goal 3: Science**

**Course coordinator:**
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**Required Text:** BIO101 Lab Manual by Blinderman and Natale. Available in the MCCC bookstore.

**Recommended Text:**
Biology, 11th Edition ISBN-10: 0134093410 ISBN-13:9780134093413 Pearson Benjamin Cummings Publishers 2016
Or
Biology, 12th Edition ISBN-13: 978-0135188743 ISBN-10: 0135188741 Pearson Benjamin Cummings Publishers 2020

**Course Student Learning Outcomes (SLO):**

Students will be able to:
1. Apply concepts of evolution to course topics [supports ILG #s1, 3, 11 and PLO #s 1, 2, 3, 4]
2. Review foundational concepts in chemistry, including the chemistry of water and organic biomolecules [supports ILG#s 1, 2, 3, 8, 11 and PLO #s 1, 2, 3, 4]
3. Elucidate the structure and function of eukaryotic cellular organelles [supports ILG #s1, 3, 11 and PLO #s 1, 2, 3, 4]
4. Describe the fluid mosaic architecture of the plasma membrane and its role in membrane transport and the maintenance of cellular homeostasis. [supports ILG #s 1, 3, 11 and PLO#s 1, 2, 3, 4]

5. Integrate concepts of energy, metabolism, biochemistry, and molecular mechanisms in an analysis of enzyme function. [supports ILG#s 1, 2, 3,11 and PLO #s 1, 2, 3, 4]
6. Examine in detail and integrate processes of cellular respiration and compare energy production in aerobes and anaerobes. [supports ILG #s 1, 3, 11 and PLO #s 1, 2, 3, 4]
7. Explore the eukaryotic cell cycle. [supports ILG#s 1, 3,11 and PLO#s 1,2,3,4]
8. Explain principles of DNA, inheritance, and genetic regulation and elucidate connection to modern genetic analysis. [supports ILG #s 1, 2, 3, 11 and PLO #s 1, 2, 3, 4]
9. Employ scientific method and practice skills in pipetting, measurement, methodology, and analysis in laboratory experiments that support lecture concepts. [supports ILG #s 1, 2, 3, 11 and PLO #s 1, 2, 3, 4,5]

**Course-specific Institutional Learning Goals (ILG):**

ILG 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
ILG 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
ILG 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
ILG 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

**Program Learning Outcomes for BIOLOGY (PLO)**

PLO 1: Demonstrate an understanding of the fundamental principles, concepts, and terminology of biology
PLO 2: Explain the structures and fundamental processes of life at molecular, cellular, and organismal levels
PLO 3: View the living world with greater understanding, insight, and appreciation as it relates to the field of biology and contemporary problems and issues
PLO 4: Demonstrate the ability to apply the scientific method of inquiry to gather and use information for the purposes of critical thinking, information analysis, and problem solving
PLO 5: Exhibit proficiency in the laboratory and in the field by using standard equipment and measurement and observation techniques that allow one to gather, analyze, and interpret qualitative data.

**Units of study in detail – Unit Student Learning Outcomes:**

**Unit I Introduction, Evolutionary Biology, Chemistry, Water, Carbon, and Biomolecules**
**[**Supports Course SLO #1, 2, 9]

***Learning Objectives***
***The student will be able to:***

**Introduction and Evolutionary Biology**
1. Define the terms evolution and biology
2. Examine whale evolution as example of adaptation over geological (millions of years) time
3. Compare the age of the planet to the age of living organisms
4. Describe characteristics of living things including regulation, energy processing, growth and development, reproduction, response to environment, evolutionary adaptation, and order
5. Contrast unicellular and multicellular life forms
6. Discuss cells as the most basic form of life

7. Examine characteristics of cells including cell membrane, DNA (the genetic material), cellular reproduction
8. Contrast prokaryotic and eukaryotic cells and provide examples of each
9. Analyze evolution as the core theme in biology
10. Review the age of the earth and the age of life in billions of years
11. Define taxonomy and discuss its utility in classification of living things
12. Review the characteristics and examples of the 3 domains of life including bacteria, Archaea, and Eukarya. Place organisms in the correct domain.
13. Discuss why evolution is considered the major theme in biology
14. Examine the work of Charles Darwin and *On the Origin of Species by Means of Natural Selection* (1859).
15. Describe in detail natural selection includes random variation, more offspring produced than can survive, competition, adaptation at the species level, reproductive fitness, heritable traits
16. Discuss microevolution (genetic change on population level) and speciation
17. Examine examples of adaptations in plants and animals and analyze the mammalian forelimb as an example of homologous structures with an evolutionary relationship
18. Explore the Galapagos finch as an example of ancestral and descendent species
19. Contrast between hypothesis and theory in science. Provide an example of a scientific theory.
20. View biology as a science of the natural world and its reliance on evidence based data
21. Explain hypothesis testing and why a valid hypothesis is testable, falsifiable
22. Construct an experiment using the scientific method including an experimental variable, control treatment (group), controlled variables, dependent variable (lab)
23. Practice the metric system of measurement and laboratory equipment and instrumentation (lab)

**Chemical Context of Life**

1. Contrast the following terms and concepts: matter, element, compound
2. Examine the elements essential to life including CHON
3. Provide an example of a trace element important in normal body functioning
4. Examine an atom and its subatomic particles
5. Discuss the use of radioactive isotopes
6. Distinguish between a structural and molecular formula
7. Contrast covalent, ionic, and hydrogen bonds
8. Explain importance of molecular structure with respect to function
9. Analyze a reaction to identify the reactants and the products.
10. Provide the molecular formula and common names of the reactants and products in photosynthesis

**The Importance of Water to Life**

1. Discuss the importance of water as medium for life on Earth
2. Examine why water is considered to be polar and its ability to form hydrogen bonds
3. Describe how the properties of water support life: cohesion, adhesion, and surface tension, temperature (including kinetic energy, heat, and specific heat), and water as a solvent
4. Discuss ability of water to retain and release heat and relevance to cells, lakes, and oceans
5. Describe the effects of evaporative cooling. Explain how sweating enables some life forms to survive.
6. Explore water as a solvent including the definitions of solute, solvent, hydrophilic, hydrophobic, and aqueous solutions
7. Explain the relationship between pH and H+ ions, and the logarithmic pH scale
8. Provide examples of acids, bases, and neutral substances
9. Explain why buffers are essential to living organisms
10. View the negative consequences of acid rain and global warming in terms of water on Earth
11. Determine the pH of substances and perform an experiment to investigate buffer action (lab)

**Carbon and Life**

1. Examine the ability of carbon to form complex and diverse molecules

2. Contrast organic with inorganic molecules
3. Provide examples of organic molecules
4. Analyze the bonding of carbon atoms with hydrogen, oxygen, and nitrogen atoms
5. Provide a definition and examples of hydrocarbons
6. Define isomer and provide examples of isomers
7. Recognize 7 functional groups: hydroxyl, carbonyl, carboxyl, amino, sulfhydryl, phosphate, methyl

**Biomolecules**

1. Identify 4 classes of large biomolecules and distinguish between a monomer and a polymer
2. Outline carbohydrates: simple sugars, disaccharides, starches, monomers, polymers
3. Discuss the importance of glucose, starch, cellulose, glycogen, and chitin in living organisms
4. Compare and contrast the carbohydrates found in animals and plants and the difference between structural and storage polysaccharides
5. Describe categories of lipids including fats (saturated, unsaturated), steroids (including cholesterol) and phospholipids
6. Recognize the importance of phospholipid structure to cell membranes
7. Provide examples of the functions of various proteins
8. Discuss the function and characteristics of enzymes
9. View the 20 amino acids
10. Examine the primary, secondary, tertiary, and quaternary structures of proteins and differentiate between each level of complexity
11. Explain why protein denaturation affects protein function
12. Define: DNA, nucleotide, gene, and chromosome
13. Analyze nucleotide structure: nitrogenous base, deoxyribose sugar, and phosphate group
14. Explore the sugar/phosphate backbone in a DNA helical polymer
15. Practice base complementation (A:T G:C) to determine the second strand of DNA given one strand
16. Analyze data from a series of experiments on enzyme action (lab)
17. Perform a series of experiments to determine the chemical composition of substances (lab)
18. Determine the independent variable, dependent variables, and controlled variables in a laboratory exercise on biomolecules (lab)

**Unit II Cell Biology, Membrane Transport, Metabolism and Cellular Respiration [**Supports Course SLOs # 1, 3, 4, 5, 6, 9]

***Learning Objectives***
***The student will be able to:***

**Cell Biology**

1. Examine cells as the fundamental units of life
2. Compare the architecture of prokaryotic and eukaryotic cells
3. Distinguish between a nucleoid region and a nucleus
4. Describe the architecture of the phospholipid bilayer of cell membranes and explain how this structure is a selectively permeable
5. Explain why a high surface area to volume ratio is advantageous for cells
6. Detail the components of eukaryotic nuclear membrane including double layer, pores.
7. Find and describe the nucleolus, chromatin
8. View cellular locations of ribosomes (bound and free), describe role in protein synthesis
9. List components of the endomembrane system: endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles
10. Examine location of smooth ER, rough ER and describe the general functions of each
11. Explain why RER is both membrane factory, protein modifier, and maker of vesicles
12. Examine cisternae, and the cis and trans faces of the Golgi apparatus
13. View the Golgi and a protein modifier and its synthesis of transport vesicles

14. Analyze the lysosome with respect to its role in degradation and recycling of macromolecules
15. Associate phagocytosis and the formation of a food vacuole with lysosome activity
16. Discuss utility of contractile vacuoles in the regulation of water in some Protista
17. View a plant central vacuole and note its size and role in storage of molecules, water, and isolation of harmful materials from the cell
18. Examine the architecture and function of mitochondria
19. Identify photosynthesis as the reaction that occurs within the plant chloroplast
20. Discuss the role of the cytoskeleton in the maintenance of cellular structure, organization, and movement (motor proteins)
21. Contrast microtubules, microfilaments, and intermediate filaments
22. Locate cellular centrosomes and examine the microtubule-based double centrioles
23. View flagella and cilia as motile structures employing microtubule architecture
24. Describe the structure and function of the extracellular matrix
25. Examine cells using light microscopy from the animal, plant, and fungi kingdoms of life (lab)
26. Discuss the structure of each organelle found in a plant and animal cell using models (lab)

**The Plasma Membrane**

1. Examine the fluid mosaic model of plasma membrane including membrane fluidity
2. Examine role of fatty acids, cholesterol, and phospholipids in the plasma membrane
3. Discuss features of membrane proteins: peripheral, integral, transmembrane, amphipathic
4. Analyze how the plasma membrane enables the cell to be selective
5. Provide an example of a receptor protein embedded in the plasma membrane
6. Describe how transport proteins, aquaporins, carrier proteins, and channel proteins allow the passage of molecules through the membrane and provide examples of these molecules
7. Discuss the role of glycoproteins in cell-cell recognition
8. Discuss diffusion as a passive transport process and the passage of molecules across membranes
9. Detail the importance of osmosis to cells and the difference in cellular response to isotonic, hypertonic, and hypotonic solutions in animal and plant cells
10. Describe facilitated diffusion as a passive process that uses transport proteins and provide an example of a molecule transported by facilitated diffusion
11. Contrast active and passive transport processes
12. Describe in detail the sodium/potassium pump as an active transport process and the role of electrochemical gradients in membrane potential
13. Examine the bulk transport processes of endocytosis and exocytosis
14. Examine the role of the lysosome in phagocytosis
15. Contrast pinocytosis and phagocytosis
16. Generate and analyze data from experiments on diffusion and osmosis (lab)
17. Expose cells to hypertonic and hypotonic environments and analyze data (lab)

**Metabolism**

1. Define metabolism
2. Detail a metabolic pathway and explain the role of enzymes in metabolism
3. Compare catabolic and anabolic processes
4. Examine cellular respiration, $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ as exergonic reaction
5. Examine photosynthesis, $6CO_2 + 6H_2O$ (+ light energy) $\rightarrow C_6H_{12}O_6 + 6O_2$ as an endergonic reaction
6. Describe the cell as an open system not in equilibrium
7. Explain how enzymes speed up metabolic reactions by lowering energy barriers ($E_a$)
8. Analyze a graph comparing a reaction with, and without, an enzyme. View the transition state.
9. Examine the effect of temperature and pH on enzyme activity
10. Define: substrate, reactant, product, enzyme, active site, induced fit, ES complex
11. View role of cofactors and coenzymes in enzyme activity. Contrast vitamins and minerals.
12. Compare competitive inhibitors and non-competitive inhibitors in enzyme action
13. Explain how allosterically regulated enzymes have active and inactive forms

14. Discuss the mechanism of feedback inhibition in the regulation of metabolic processes

**Cellular Respiration**

1. Examine the connectedness between photosynthesis and cellular respiration
2. Compare the exergonic breakdown of molecules in fermentation, aerobic respiration, and anaerobic respiration
3. Discuss 3 processes in cellular respiration: glycolysis, the citric acid cycle, and oxidative phosphorylation, relative amounts of ATP production, and cellular location
4. Examine the oxidation of glucose to pyruvate in glycolysis and explain the fate of each reactant in this reaction
5. Understand that glycolysis includes 10 enzymatic steps and occurs in cytoplasm of all cells
6. Examine the mechanism of the 8 enzymatic steps in the citric acid cycle (Krebs cycle)
7. Explain how pyruvate enters mitochondria and is modified prior to the citric acid cycle
8. Describe (in general) the role of NADH and FADH2 generated from glycolysis and the citric acid cycle in the electron transport chain
9. Review the role of the electron transport chain in the mitochondrial cristae
10. Describe the role of H+ ions and ATP synthase in the generation of ATP
11. Relate the sequence glucose $\rightarrow$ NADH $\rightarrow$ electron transport chain $\rightarrow$ proton-motive force $\rightarrow$ ATP to cellular respiration
12. Describe conversion of pyruvate to ethanol in alcohol fermentation in yeast
13. Describe conversion of pyruvate to lactic acid in fungi, bacteria, and muscle cells
14. Contrast facultative anaerobes, obligate aerobes, and obligate anaerobes
15. Conduct experiments and analyze data from animals, plants, and yeast experiments in the generation of CO2 from cellular respiration or fermentation (lab)

**Glycolysis** cytoplasm
- Glucose oxidized: 1 glucose → 2 ATP and 2 pyruvate
- NAD+ reduced to NADH
- No $O_2$ required, no $CO_2$ produced
- Energy investment and energy payoff phases (net gain 2 ATP)

**Citric Acid cycle** mitochondrial matrix
- 2 ATP per 1 glucose (2 pyruvate)
- $CO_2$ generated
- NADH and FADH2 (electron donors) generated
- Pyruvate converted to acetyl CoA prior to cycle

**Oxidative phosphorylation** Occurs in mitochondrial cristae
- NADH and FADH2 donate electrons to electron transport chain
- Cytochrome proteins involved
- Oxygen required
- H+ gradient drives ATP synthase
- ~36 ATP per glucose total for cellular respiration

**Fermentation Occurs** in cytoplasm
- Anaerobic
- Uses pyruvate
- Generates alcohol (or lactic acid)
- Generates NAD+ to be used in sustaining glycolysis

**Unit III: The cell cycle, meiosis, heredity, DNA replication and gene expression** [supports course SLO #s 1, 7, 8, 9]

***Learning Objectives***
***The student will be able to:***

**The Cell Cycle**

1. Examine the role of binary fission in the reproduction of unicellular organisms
2. Explain reasons why somatic cells undergo cellular reproduction
3. Distinguish between somatic and gamete cells
4. Differentiate diploid from haploid
5. Contrast mitosis and cytokinesis
6. Examine in detail interphase and mitosis phases of the cell cycle
7. Compare the G1, S, G2, and Go phases of interphase in terms of cellular events
8. Follow sister chromatids during interphase and mitosis (P, M, A, T)
9. Describe the formation and role of mitotic spindle in mitosis
10. Examine centrosomes and the centrioles contained within them
11. Describe how the mitotic spindle moves chromosomes
12. Contrast interphase, prophase, metaphase, anaphase, telophase and cytokinesis
13. Contrast a cleavage furrow observed in animal cells with a cell plate in plant cells
14. Compare cell cycle length in an embryonic cell and a brain cell
15. Describe the role of cell cycle checkpoints
16. Examine blastula and onion root tips to uncover hallmarks of cell cycle phases (lab)
17. Complete interactive exercises to analyze the role of organelles and other cellular structures in the cell cycle (lab)

**Meiosis**

1. Define heredity, variation, and genetics
2. Examine human somatic cells with 46 chromosomes as homologous pairs in a karyotype
3. View a karyotype to recognize autosomes and sex chromosomes
4. 23 + 23 = 46 represents human fertilization. Review chromosomes in the human life cycle
5. Distinguish between diploid and haploid cell, somatic and germ cells (gametes)
6. Compare mitosis and meiosis in terms of role and cellular outcomes
7. Contrast oogenesis with spermatogenesis
8. Describe Interphase I including DNA replication
9. Describe Prophase I: crossing over and synapsis, chiasmata
10. Describe Metaphase I including the tetrads on the metaphase plate
11. Describe Anaphase I: separation of homologous chromosomes with sister chromatids joined
12. Describe Telophase I and cytokinesis, haploid chromosomes in daughter cells
13. Describe Prophase II, Metaphase II, Anaphase II and Telophase II to explain how 4 haploid and unique cells are produced via meiosis
14. Examine independent assortment, crossing over, and fertilization as generators of genetic diversity in species.

**Heredity**

1. Describe the work of Gregor Mendel (1800s)
2. Explain the characteristics of the pea plant that make it a useful genetic model
3. Differentiate between a character (gene) and a trait (allele)
4. Explain how Mendel's ability to cross fertilize or self- fertilize pea plants allowed control mating
5. Distinguish between a true-breeding parental, f1, and f2 generation in a monohybrid cross
6. Discuss the principle of dominance
7. Examine phenotypes that result from particular genotypes
8. Contrast between homozygous recessive, heterozygous, homozygous dominant genotypes
9. Discuss the principle of random segregation of alleles into gametes
10. Employ the Punnett square in one gene crosses
11. View two gene crosses to illustrate the principle of independent assortment of genes into gametes (assume genes on different chromosomes)

12. Use a dihybrid cross to illustrate independent assortment. Construct a Punnett square to examine genotypic and phenotypic frequencies of offspring
13. Explain codominant relationship between the $I^A$ and $I^B$ $I^B$ alleles in humans
14. Examine blood alleles $I^A$ $I^B$ and i alleles in humans to illustrate multiple alleles. Use Punnett square to determine frequencies of blood types in offspring
15. Contrast single gene traits with polygenic traits and provide examples of each
16. View albinism as an example of a recessively inherited trait
17. View achondroplasia as an example of a dominantly inherited trait
18. List examples of disorders that have a multifactorial component (genetics + environment)
19. Provide an example of a phenotype that results from the interaction of a number of gene products (polygenic trait)
20. Provide an example of a trait that has a norm (range of phenotypes given one genotype)
21. Investigate the transmission of genetic traits in humans and specimen (lab)

**Chromosomes**

1. Describe chromosome theory of inheritance and how it differs from Mendel's work
2. Explain why most sex-linked genes are located on X chromosome rather than Y
3. Describe XY sex determination system
4. Compare heterozygous and homozygous females for X-linked traits
5. Examine colorblindness as example of X-linked gene and explain prevalence in males.
6. Compute the expected number of Barr bodies in a somatic cell nucleus and explain the relationship between X inactivation and this structure
7. Explain why unlinked genes assort independently into gametes
8. Correlate non-disjunction during meiosis to chromosomal changes in gametes and offspring
9. Provide an example of a viable human monosomy (2n-1)
10. Provide an example of a viable human trisomy (2n +1)
11. Contrast duplications, deletions, inversions, and translocations
12. Explain the maternal inheritance of extranuclear mitochondrial DNA

**DNA**

1. Examine composition of DNA including Chargaff's observations concerning relative concentrations of purines and pyrimidines
2. Identify the 4 nucleotide building blocks of DNA
3. Describe the Watson and Crick model of DNA: X-ray diffraction data, complementary base pairing, antiparallel strands, sugar phosphate backbone, and hydrogen bonds
4. Be able to determine the complementary strand of DNA given a template strand
5. Describe semiconservative replication of DNA. Include enzymes and other proteins and role of each (helicase, SSB, DNA polymerase, primase, ligase)
6. State the importance of the origin of replication in the initiation of DNA replication
7. Examine a replication fork and label components that interact with it
8. Review 5' -> 3' polymerase activity of DNA pol and difference between continuous synthesis on leading stranding and discontinuous synthesis on lagging strand
9. Examine that DNA pol requires an RNA primer (made by primase) and template DNA
10. Describe Okazaki fragments generation and attachment by DNA ligase
11. Explain the end replication problem
12. Note that telomeres shorten with each round of DNA replication that some cell types preserve telomeres by telomerase

**From Gene to Protein**

1. Define gene expression, gene, transcription, translation
2. Note that uracil, is used in RNA and that RNA molecules single stranded
3. View ribosomes as assembly units for polypeptides. Note large and small subunits

4. Describe the genetic code including: triplet code, codon, start codon, stop codons, redundancy, non-overlapping and become familiar with the use of a codon table
5. Explain initiation of transcription and role of the promoter. View upstream and downstream regions of gene
6. Examine elongation of the mRNA transcript by RNA pol in 5'->3' direction
7. View termination of transcription and release of the mRNA transcript
8. View transfer RNA structure and function in translation including the anticodon and amino acid site
9. Examine the small and large subunits of the ribosome
10. Describe initiation of translation and the role of the AUG start codon
11. View the steps in elongation of the polypeptide chain in protein synthesis and describe the transfer of amino acids by tRNA to the growing amino acid chain.
12. View termination and release of the polypeptide chain
13. Use a codon table to translate an mRNA message

**Laboratory Specific Learning Objectives** [support SLO#s 1, 2, 3, 4, 5, 6, 7, 8, 9]
***Learning Objectives***
***The student will be able to:***

1. Construct an experiment using the scientific method including an experimental variable, control treatment (group), controlled variables, dependent variable
2. Use the metric system of measurement and laboratory equipment and instrumentation
3. Determine the pH of substances and perform an experiment to investigate buffer action
4. Perform a series of experiments to determine the chemical composition of substances
5. Determine the independent variable, dependent variables, and controlled variables in a laboratory exercise on biomolecules
6. Create and analyze data from a series of experiments on enzyme action
7. Examine cells using light microscopy from the animal, plant, and fungi kingdoms of life
8. Discuss the structure of each organelle found in a plant and animal cell using models
9. Generate and analyze data from experiments on diffusion and osmosis
10. Expose cells to hypertonic and hypotonic environments and a
11. Conduct experiments and analyze data from animals, plants, and yeast experiments in the generation of CO2 from cellular respiration or fermentation (lab)
12. Examine via microscopy preserved slides and live specimen of bacteria and protists
13. Investigate the transmission of genetic traits in humans and specimen
14. Examine blastula and onion root tips to uncover hallmarks of cell cycle phases
15. Complete interactive exercises to analyze the role of organelles and other cellular structures in the cell cycle

**Evaluation of student learning:**
Exams, homework, in-class graded activities, lab quizzes and lab practicals contribute to the points in the course. Lecture is 75% of the total points. Lab contributes 25% of the total points.
All problems for assessments and graded activities are selected to evaluate student understanding of the course student learning outcomes.

| **% of Total Points Earned:** | **Final Course Grade:** |
|---|---|
| 93 – 100 | A |
| 90 – 92 | A- |
| 87 – 89 | B+ |
| 83 – 86 | B |
| 80 – 82 | B- |
| 77 – 79 | C+ |
| 70 – 76 | C |
| 60 – 69 | D |

0 – 59 F