**Course Description:**

This course explores techniques for extracting, separating, and assaying carbohydrates, lipids, and proteins from biological samples. Topics include mechanisms for regulating metabolism and gene expression. Students will describe the morphology and process of reproduction of microorganisms important in clinical disease and biotechnology applications. Students will perform assays as a diagnostic tool to detect the presence of a pathogen. Further, students will perform separation techniques including chemical separations, centrifugation, distillation, and filtration and interpret results.

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome 1.1** **Employability Skills**

Develop career awareness and employability skills (e.g. face-to-face, online) needed for

gaining and maintaining employment in diverse business settings.

**Competencies**

1.1.2 Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3 Develop a career plan that reflects career interests, pathways, and secondary and postsecondary options.

**Outcome 1.3 Business Ethics and Law**

Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1 Analyze how regulatory compliance affects business operations and organizational performance.

1.3.9 Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.

**Outcome 1.5 Global Environment**

Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.

**Competencies**

1.5.8 Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

**Outcome 1.6 Business Literacy**

Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

**Competencies**

1.6.6 Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.

**Strand 5. Bioscience Research and Development**

Learners will demonstrate the skills and knowledge of interpreting laboratory requests, using protective clothing and hazardous material containment, specimen collection procedures, a variety of laboratory testing and techniques and maintenance of laboratory equipment and supplies.

**Outcome: 5.3. Microbiology Testing and Technology**

Describe the morphology and process of reproduction of microorganisms important in clinical disease and biotechnology applications and perform assays as a diagnostic tool to detect the presence of a pathogen when handling and storing specimens and preservatives for biologicals.

**Competencies**

5.3.1. Explain microbial taxonomy and classification systems and use them to identify microbial

organisms.

5.3.2. Compare and contrast cellular structure and functions of prokaryotic and eukaryotic cells.

5.3.3. Differentiate between bacterial metabolism, reproduction, cell structures, and their functions.

5.3.4. Identify aerobic bacteria through morphological, physical and biochemical properties.

5.3.5. Describe the structure of viruses and differentiate between types.

5.3.6. Explain virulence, pathogenicity and the factors that contribute to pathogenicity.

5.3.7. Describe types and features of passive and active transport systems.

5.3.8. Describe molecular behavior of large molecules, including carbohydrates, lipids, proteins and nucleotides.

5.3.9. Explain how chemical energy operates major cell processes (e.g., biosynthesis, movement,

transport, growth).

5.3.10. Explain factors that affect and optimize rates of enzyme assay reactions.

5.3.11. Perform an enzyme‐linked immunosorbent assay (ELISA) and interpret the results.

5.3.12. Perform biochemical assays of proteins, lipids, carbohydrates, nucleic acids and enzymes.

5.3.13. Perform an assay for pathogen and susceptibility.

5.3.14. Describe the uses and limitations of various lab assays (e.g., HPLC, immunoassay, drainage cell, multi aspect, latex agglutination, spectrophotometry).

*An “X” indicates that the pathway applies to the outcome.*

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| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |

**Outcome: 5.4. Molecular and Genetic Technology**

Perform molecular and genetic applications using knowledge of nucleic acid structure and function, DNA replication, transcription, translation, chromosome structure and remodeling and regulation of gene expression in prokaryotes and eukaryotes.

**Competencies**

5.4.1. Predict and explain offspring genotypes and phenotypes using basic mode of genetics.

5.4.2. Identify complex gene expression and transmission patterns.

5.4.3. Explain and model the structure of DNA from nucleotide to chromosome.

5.4.4. Model the Central Dogma Theory.

5.4.5. Describe the processes involved in gene regulation.

5.4.6. Identify and isolate peptides and proteins.

5.4.7. Summarize the steps in creating a recombinant DNA molecule.

5.4.8. Isolate and purify nucleic acids, including chromosomal and extra‐chromosomal DNA molecules.

5.4.9. Compare nucleic acids and chromosomal DNA molecules using a sequence database.

5.4.10. Perform and interpret the results of restriction enzyme digests.

5.4.11. Apply concepts of a pedigree.

5.4.12. Perform and interpret the results of a polymerase chain reaction.

5.4.13. Use electrophoresis to separate nucleic acids and determine molecular weight.

5.4.14. Explain results from the Human Genome project and other sequencing projects and

explain how gene sequencing is performed.

5.4.15. Perform gene analysis to determine the source of an isolated pathogen.

5.4.16. Explain the role of RNA and its role in gene expression.

*An “X” indicates that the pathway applies to the outcome.*

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| **Pathways** |  | Health Information Management | X | Medical Bioscience |  | Allied Health and Nursing | | |  | Exercise Science and Sports Medicine |
| **Green Practices** |  | Green-specific |  | Context-dependent | | |  | Does not apply | | |

**Outcome: 5.5. Laboratory Standard Operational Procedures**

Perform methods and techniques using protocols in order to conduct an experiment.

**Competencies**

5.5.1. Follow standard operating procedure (SOP) to aseptically collect and prepare dry and wet samples for analysis.

5.5.2. Prepare and dispense stock reagents, buffers, media and solutions by calculating

concentrations, adjusting factors such as pH and selecting purification techniques and

containers.

5.5.3. Test and maintain the integrity of stains, reagents, chemicals and mounts.

5.5.4. Select and apply sterilization methods for reagents, buffers, media and solutions.

5.5.5. Explain the principles of microscopy and process a specimen for light microscopy.

5.5.6. Prepare, incubate and identify colonies microscopically and macroscopically (e.g., colonial morphology, staining procedures, biochemical).

5.5.7. Perform separation techniques, including chemical separations (chromatography),

centrifugation, distillation and filtration and describe their principles and interpret the results.

5.5.8. Titrate liquids.

5.5.9. Transfer gases, liquids and solids from storage containers to equipment used in the

laboratory.

5.5.10. Use aseptic laboratory techniques while working.

5.5.11. Perform a chromatography separation of a given mixture of substances.

*An “X” indicates that the pathway applies to the outcome.*

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| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |

**Outcome: 5.6. Culturing**

Perform experimental techniques used in cell biology to study cell growth, manipulation and evaluation.

**Competencies**

5.6.1. Identify the structure of cells and the functions of their components.

5.6.2. Explain classification, composition and preparation of culture media and prepare media for

propagation.

5.6.3. Identify bacteriologic methods necessary for isolation and identification of organisms.

5.6.7. Explain the collection and handling of fungal, mycobacterial and viral specimens following standard operating procedure (SOP).

5.6.8. Explain Koch’s Postulates and their use in determining primary and secondary pathogens.

5.6.9. Describe how vectors are used to transform host and microorganisms.

5.6.10. Correlate bacterial binary fission with generation time.

5.6.16. Demonstrate cryopreservation techniques by freezing and thawing cells.

*An “X” indicates that the pathway applies to the outcome.*

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| **Pathways** |  | Health Information Management | X | Medical Bioscience | X | Allied Health and Nursing | |  | Exercise Science and Sports Medicine |
| **Green Practices** |  | Green-specific |  | Context-dependent | | X | Does not apply | | |