**Course Description:**

Students learn medical interventions that extend and improve quality of life including gene therapy, use and development of prosthetics, rehabilitation techniques, and supportive care. Students will use 3D imaging, data acquisition software, and current scientific research to design and develop medical intervention products. Students will demonstrate current and emerging strategies and technologies used for collecting, analyzing, recording and sharing information. In addition, students will develop leadership and team-building skills that promote collaboration.

**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.

1.1.5. Develop strategies for self‐promotion in the hiring process (e.g., filling out job applications,

resumé writing, interviewing skills, portfolio development).

1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate

associated behaviors in fulfilling personal, community and workplace roles.

1.1.7. Apply problem‐solving and critical‐thinking skills to work‐related issues when making decisions

and formulating solutions.

1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive

behavior.

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

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| **Pathways** |  | Exercise Science | X | Allied Health and Nursing | X | Bioscience Research and Development |  | Health Informatics |
| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 1.2. Leadership and Communications**

Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

**Competencies**

1.2.1. Extract relevant, valid information from materials and cite sources of information (e.g.,

medical reports, fitness assessment, medical test results).

1.2.2. Deliver formal and informal presentations.

1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.4. Use negotiation and conflict‐resolution skills to reach solutions.

1.2.5. Communicate information for an intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem‐solving and consensus‐building techniques to draw conclusions and determine

next steps.

1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence

internal and external workplace relationships.

1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications.

1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a

team.

1.2.11. Write professional correspondence, documents, job applications and resumés.

1.2.12. Use technical writing skills to complete forms and create reports.

1.2.13. Identify stakeholders and solicit their opinions.

1.2.14. Use motivational strategies to accomplish goals.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

**Competencies**

1.4.2. Select and use software applications to locate, record, analyze and present information (e.g.,

word processing, e‐mail, spreadsheet, databases, presentation, Internet search engines).

1.4.3. Verify compliance with security rules, regulations and codes (e.g., property, privacy, access,

accuracy issues, client and patient record confidentiality) pertaining to technology specific to

the industry pathway.

1.4.4. Use system hardware to support software applications.

1.4.6. Use an electronic database to access and create business and technical information.

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**Strand 2. Human Body System**

Learners will discuss the various forms, functions and pathophysiology associated with body systems and alterations related to the normal aging process, obtain a health history, perform an evaluation of body systems and document using medical terminology.

**Outcome: 2.1. Human Body Form, Function and Pathophysiology**

Discuss the various human body systems, alterations related to the normal aging process and possible dysfunctions.

**Competencies**

2.1.1. Describe the physical characteristics, components and function of blood (e.g., ABO, Rh, blood

cells, precursors and respiratory).

2.1.3. Describe how blood pressure is controlled and factors influencing changes in blood pressure.

2.1.4. Describe the function and components of the respiratory system and pulmonary ventilation

and factors influencing respiratory rates.

2.1.5. Describe nerve tissue and the nervous system, including regions of the brain and their

function, the spinal nerves, signal transmission at synapses and the sympathetic and

parasympathetic system.

2.1.8. Describe the urinary system structures and principles of glomerular filtration, electrolyte

exchanges and their role in the production of red blood cells and the control of blood

pressure.

2.1.10. Describe the sensory system, related structures and functions.

2.1.14. Describe the difference between pathology and physiology and the conditions typically

observed during a disease state.

2.1.15. Explain the pathophysiology changes associated with or resulting from disease or injury.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Strand 3. Therapeutic Interventions**

Learners will administer or assist with environmental, health promotion, pharmacological, emergency, nutritional, exercise and rehabilitative and dental and surgical interventions and/or procedures to improve the individuals’ outcome and quality of life across the life span within their scope of practice, evaluate outcomes and ensure individual’s rights.

**Outcome: 3.2. Health Promotion Interventions**

Identify and communicate health promotion and wellness to individuals, families and communities.

**Competencies**

3.2.5. Share information to promote, maintain and restore.

3.2.6. Communicate the importance of age‐appropriate healthy eating, exercise and preventative

medicine.

3.2.7. Communicate the medical benefits and risks associated with immunizations across the life

span.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 3.3. Pharmaceutical Interventions**

Prepare, administer, store and document medications, reactions and outcomes according to laws, regulations and authorized health care provider orders and protocols.

**Competencies**

3.3.1. Identify and define terms related to drugs, pharmacology and medicines.

3.3.2. Identify drug classifications.

3.3.6. Describe the therapeutic value of the medication being taken and how to evaluate the

individual’s outcome.

3.3.13. Identify causes for altered body states (e.g., hallucinogens, sensory deprivation) and corrective

actions.

3.3.14. Recognize fluid and electrolyte imbalances, side‐effects and adverse reactions.

3.3.15. Apply standard practices and procedures that prevent contamination of pharmaceutical

products.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Strand 4. Assistive Care**

Learners will demonstrate the skills and knowledge to provide personal assistive care for the activities of daily living to a variety of individuals across the life span within their scope of practice.

**Outcome: 4.1. Scope of Practice**

Demonstrate the roles and responsibilities of assistive personnel and identify the medical specialists who treat disorders of each body system.

**Competencies**

4.1.5. Identify the medical specialists who treat disorders of each body system.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 4.3. Pathogenic Microorganisms, Infection Control and Infection**

Use basic principles of infection control to prevent the growth and spread of pathogenic microorganisms and infection.

**Competencies**

4.3.1. Describe the chain of infection (e.g., host, vectors, portal of entry).

4.3.2. Describe mechanisms for the spread of infection, including airborne, vector‐borne, common

vehicle, droplet and contact.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**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.

**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. Explain 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. Identify the components of a nucleotide and differentiate from nucleosides.

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

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

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

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

transport, growth).

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

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

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

5.3.14. Perform bioassays for pathogens.

5.3.15. Distinguish uses and limitations of various assays.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 5.4. Bio‐Molecular Technology**

Perform bio‐molecular 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 Mendel’s Laws and a Punnett

square.

5.4.2. Explain alternative forms of transmission (e.g., non‐Mendelian inheritance).

5.4.3. Explain, model and predict the three‐dimensional shape, bonding patterns (covalent and

hydrogen bonds) and antiparallel nature of deoxyribonucleic acid (DNA).

5.4.4. Model the Central Dogma Theory (e.g., replication, transcription, translation).

5.4.5. Describe the processes involved in gene regulation (e.g., histone acetylation, RNA stability, cotranslational and post‐translational modifications).

5.4.6. Discuss alternative types of gene expression (e.g., sex‐limited, sex‐linked, partial dominance,

epistatic, pleiotropic).

5.4.7. Identify, isolate and manipulate peptides and proteins (i.e., primary, secondary, tertiary,

quaternary).

5.4.8. Describe and perform the steps in creating a recombinant DNA molecule.

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

molecules.

5.4.10. Compare nucleic acids and chromosomal DNA molecules using a sequence database (e.g.,

Genebank®).

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

5.4.12. Apply concepts of screening genetic expression, expression vectors and genetic libraries.

5.4.13. Perform and interpret the results of a Polymerase chain reaction.

5.4.14. Explain applications of Southern and Northern Blot Analysis.

5.4.15. Isolate, quantitate (e.g., Bradford assay) and characterize proteins (e.g., Western Blot

analysis).

5.4.16. Perform antibiotic resistance cloning techniques, including vector preparation, transformation

and selection.

5.4.17. Perform spectroscopy of biological materials explaining the principles behind the procedures,

the purpose of a blank and determine the concentration of biomolecular samples.

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

how gene sequencing is performed.

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

5.4.20. Explain the growing knowledge base regarding RNA and its role in gene expression.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

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

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

**Competencies**

5.5.5. Perform laboratory measures by calculating and preparing a serial dilution, calculating

quantities needed to perform a test analysis and calculating unit conversions and

concentrations (graphing results).

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

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

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

5.5.13. Comply with industry‐based and required regulatory quality‐assurance practices (e.g., quality

control [QC], Good Laboratory Practice [GLP], Good Manufacturing Practice [GMP]) for

documentation.

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| **Pathways** |  | Exercise Science |  | Allied Health and Nursing | X | Bioscience Research and Development |  | Health Informatics |
| **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**

5.6.2. 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.

5.6.4. Operate centrifuge, microscope, compound microscope, spectrophotometer, incubator,

colony counter, pipets and other basic microbiology and analytical equipment and using

microscopes, examine biological specimens.

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

5.6.6. Prepare, incubate and identify colonies microscopically and macroscopically (e.g., colonial

morphology, staining procedures, biochemical).

5.6.7. Isolate, propagate, maintain and harvest pure cell lines.

5.6.8. Verify culture cell lines and determine the cause or causes of culture failures.

5.6.9. Explain the collection and handling of fungal, mycobacterial and viral specimens.5.6.11.

5.6.12. Correlate bacterial binary fission with generation time.

5.6.13. Describe physical factors that affect microbial growth and identify a normal bacteria

population growth curve.

5.6.14. Conduct a shelf‐life study to determine physical change and biological growth.

5.6.15. Conduct a thermal death time study on an organism.

5.6.18. Explain how cell cultures can be used to assay viability and cytotoxicity.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 5.7. Bioreactor Technologies**

Describe and perform bioreactor procedures (e.g., fermentation, sterilization).

**Competencies**

5.7.1. Maintain, classify and analyze types and classes of bioreactors and associated materials.

5.7.2. Explain the principles and importance of sterility in industrial fermentations.

5.7.3. Explain the temperature/pressure relationship of saturated steam to sterilization.

5.7.4. Explain the effect of entrapped air on sterilization effectiveness.

5.7.5. Compare sterilization methods using dry heat versus moist heat.

5.7.6. Demonstrate sterilization by micro‐filtration.

5.7.7. Explain the effect of suspended solids in fermentation media on sterilization effectiveness.

5.7.8. Describe the sources and forms of energy, the relationship between heat and temperature,

how heat is transferred and the factors that affect the rates of reaction in processing.

5.7.9. Describe the functions and physical properties of simple and complex carbohydrates, lipids

and proteins in the fermentation process.

5.7.10. Describe the roles of enzymes as catalysts and the factors that affect enzyme activity in the

fermentation process.

5.7.11. Describe the relationship of oxygen transfer rates to mass transfer.

5.7.12. Perform applications using benchtop fermentor and bioreactor systems.

5.7.13. Monitor microorganism growth and determine the viability of cells.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Outcome: 5.8. Biotechnology Research and Experiments**

Conduct a problem‐based study, applying scientific methodology and using descriptive statistics to communicate and support predictions and conclusions.

**Competencies**

5.8.5. Select and apply sampling methods that appropriately represent the population to be studied.

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| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |

**Strand 6. Health Information Management**

Learners will demonstrate basic computer literacy, health information literacy and skills, confidentially and privacy of health records, information security and basic skills in the use of electronic health records.

**Outcome: 6.1. Health Information Literacy**

Apply principles of systems operations used to capture, retrieve and maintain information from internal and external sources.

**Competencies**

6.1.2. Differentiate between primary and secondary health data sources and databases.

6.1.4. Describe the principles of structure, design and use of health information (e.g., individual,

comparative, reports, trended data).

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

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| **Pathways** |  | Exercise Science |  | Allied Health and Nursing | X | Bioscience Research and Development |  | Health Informatics |
| **Green Practices** |  | Green-specific |  | Context-dependent | X | Does not apply | | |