General Nursing (ATC)

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Office of the State Superintendent of Education
Postsecondary and Career Education Division
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The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Health Science: General Nursing Program of Study. The academic standards in this document are theoretical and performance-based. The standards contain content from Colorado, Maryland, Tennessee, and Texas and were validated by D.C. business and industry partners. All content is used with permission.

In addition to academic standards, OSSE has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study.

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General Nursing		
Course Level	**Course Information**	**Description**
Level I	**Principles of Health Science** **OSSEID:** 14251G1.0014 **Grades:** 9-12 **Prerequisite:** None **Credit:** 1	The Principles of Health Science course is designed to provide an overview of the therapeutic, diagnostic, health informatics, support services, and biotechnology research and development systems of the health care industry.
Level II	**Medical Terminology/Nutrition Wellness** **OSSEID:** 14900G1.0024 **Grades:** 10-12 **Prerequisite:** Principles of Health Science **Credit:** 1	The Medical Terminology course is designed to introduce students to the structure of medical terms, including prefixes, suffixes, word roots, singular and plural forms, and medical abbreviations. The course allows students to achieve comprehension of medical vocabulary appropriate to medical procedures, human anatomy and physiology, and pathophysiology.
Level III	**Anatomy and Physiology** **OSSEID:** 14901G1.0034 **Grades:** 11-12 **Prerequisite:** Medical Terminology **Credit:** 1	The Anatomy and Physiology course is designed for students to conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Anatomy and Physiology will study a variety of topics, including the structure and function of the human body and the interaction of body systems for maintaining homeostasis.
Level IV	**Medical Microbiology** **OSSEID:** 4902G1.0044 **Grades:** 12 **Prerequisite:** Anatomy and Physiology **Credit:** 1	The Medical Microbiology course is designed to explore the microbial world, studying topics such as pathogenic and non-pathogenic microorganisms, laboratory procedures, identifying microorganisms, drug resistant organisms, and emerging diseases.

Industry Certifications

Work-Based Learning Examples and Resources

Level I Course	Level II Course	Level III Course	Level IV Course
Career Exploration Industry Visits Guest Speakers Participate in a CTSO	**Career Awareness** *All of Level I, plus:* Postsecondary Visits Program-Specific Site Tours Mock Interviews	**Career Preparation** *All of Level I and II, plus:* Job Shadow Paid/Unpaid Internships	**Career Preparation** Paid/Unpaid Internships Apprenticeships

Several resources are available to help instructors meet the Level I and Level II WBL requirements, including:

Career Coach DC (http://careercoachdc.emsicc.com). Online site designed to help students find and connect to a career pathway by providing the most current local data on wages, employment, job postings, and associated education and training. The resource includes a Career Assessment for students.

Nepris (https://dc.nepris.com/). Connects educators and learners with a network of industry professionals virtually, bringing real-world relevance and career exposure to all students. Nepris also provides a skills-based volunteering platform for business and industry professionals to extend their educational outreach.

Virtual Job Shadow (https://virtualjobshadow.com). Provides interactive tools which empower students to discover, plan, and pursue their dreams. Rich video library presents a "day in the life of" view for thousands of occupations.

Labor Market Information Definitions and Data

Career and Technical Education programs of study in the District of Columbia must meet at least one of the High Wage, High Skill, and In-Demand definitions below to be considered appropriate for our students and the regional labor market. These definitions were created in collaboration with Career and Technical Education leaders from District of Columbia LEAs, the University of the District of Columbia Community College, and national guidance from Research Triangle International (RTI) and Education Northwest. Additionally, previous work was consulted by researchers at MIT's Labor Wage Index Project and the DC CTE Task Force's 2012 Strategic Plan for the District of Columbia.

Indicator	Definition	Data for the General Nursing Program of Study (source: EMSI, August 2022)
High Wage	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the District of Columbia, and/or leads to a position that pays at least the median hourly or annual wage for the Washington, DC, metropolitan statistical area. *Note: A 25th percentile hourly wage of $23.13 or greater is required to meet this definition.*	**Standard Occupational Code (SOC):** 29-1062.00 Family and General Physicians **Hourly Wages** **25th Percentile:** $84.18 **50th Percentile:** $112.68 **75th Percentile:** $151.80
High Skill	Those occupations located within the Washington, DC, metropolitan statistical area with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, or higher.	**Typical Entry-Level Education:** Postsecondary Nondegree Award Bachelor's Degree
In-Demand	Those occupations in the Washington, DC, metropolitan statistical area having more than the median number of total **(growth plus replacement)** annual openings over a five-year period. *Note: An occupation is required to have an annual growth plus replacement rate of 105 openings, or greater, between 2021-2026 to meet this definition.*	**Annual Openings:** 112

Model Six-Year Plan: General Nursing Program of Study

College: University of the District of Columbia Community College
Program/CIP:
Plan:

Entity: Office of the State Superintendent of Education
Career Cluster: Health Science
Program of Study: General Nursing

High School					College			
Subject	**9th Grade**	**10th Grade**	**11th Grade**	**12th Grade**	**Semester I**	**Semester II**	**Semester III**	**Semester IV**
English (4)	English I	English II	English III	English IV				
Math (4)	Algebra I	Geometry	Algebra II	Math				
Science (4)	Biology	Lab Science	Anatomy and Physiology	Science				
Social Studies (4)	World History and Geography I: Middle Ages	World History and Geography II: Modern World	U.S. History	U.S. Government (.5) and D.C. History (.5)				
Health (.5) and Physical Ed (1)	Health (.5) Physical Ed (.5)	Physical Ed (.5)						
World Languages (2)			World Language I	World Language II				
Art (.5)		Art (.5)						
Music (.5)		Music (.5)						
Elective / Major Courses	Principles of Health Science	Medical Terminology	Anatomy/ Physiology	Medical Microbiology				
Total possible college credits completed in high school: XX					***Credit hours required to complete the AAS program: XX***			

Course Standards

Principles of Health Science

1. **General requirements.** This course is recommended for students in Grades 9 through 12. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

   B. The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

   C. The Principles of Health Science course is designed to provide an overview of the therapeutic, diagnostic, health informatics, support services, and biotechnology research and development systems of the health care industry.

   D. Students will participate in at least two Career Exploration Work-Based Learning experiences in this course, which might include guest speakers and work-place tours relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. express ideas in a clear, concise, and effective manner;
      2. exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and
      3. identify employer expectations such as punctuality, attendance, time management, communication, organizational skills, and productive work habits.

   B. **The student applies mathematics, science, English language arts, and social studies in health science.**
      1. **The student is expected to:**
      2. convert units between systems of measurement;
      3. apply data from tables, charts, and graphs to provide solutions to health-related problems;
      4. interpret technical material related to the health science industry;
      5. organize, compile, and write ideas into reports and summaries;
      6. plan and prepare effective oral presentations;
      7. formulate responses using precise language to communicate ideas;
      8. describe biological and chemical processes that maintain homeostasis;
      9. identify and analyze principles of body mechanics and movement such as forces and the effects of movement, torque, tension, and elasticity on the human body;

10. identify human needs according to Maslow's Hierarchy of Human Needs;
11. describe the stages of development related to the life span;
12. identify the concepts of health and wellness throughout the life span;
13. analyze and evaluate communication skills for maintaining healthy relationships throughout the life span;
14. research the historical significance of health care;
15. describe the impact of health services on the economy;
16. analyze the impact of local, state, and national government on the health science industry;
17. identify diverse and cultural influences that have impacted contemporary aspects of health care delivery; and
18. research and compare practices used by various cultures and societies to solve problems related to health.

C. **The student uses verbal and nonverbal communication skills. The student is expected to:**
   1. identify components of effective and non-effective communication;
   2. demonstrate effective communication skills for responding to the needs of individuals in a diverse society;
   3. evaluate the effectiveness of conflict-resolution techniques in various situations; and
   4. accurately interpret, transcribe, and communicate medical vocabulary using appropriate technology.

D. **The student implements the leadership skills necessary to function in a democratic society. The student is expected to:**
   1. identify traits of a leader;
   2. demonstrate leadership skills, characteristics, and responsibilities of leaders such as goal-setting and team building; and
   3. demonstrate the ability to effectively conduct and participate in meetings.

E. **The student assesses career options and the preparation necessary for employment in the health science industry. The student is expected to:**
   1. locate, evaluate, and interpret career options and employment information; and
   2. recognize the impact of career decisions, including the causes and effects of changing employment situations.

F. **The student identifies academic preparation and skills necessary for employment as defined by the health science industry. The student is expected to identify academic requirements for professional advancement such as certification, licensure, registration, continuing education, and advanced degrees.**

G. **The student identifies the career pathways related to health science. The student is expected to:**
   1. compare health science careers within the diagnostic, therapeutic, health informatics, support services,
   2. and biotechnology research and development systems; and
   3. identify the collaborative role of team members between systems to deliver quality health care.

H. **The student examines the role of the multidisciplinary team in providing health care.**
   1. **The student is expected to:**
   2. Explain the concept of teaming to provide quality health care; and
   3. examine the role of professional organizations in the preparation and governance of credentialing and certification.

I. **The student interprets ethical behavior standards and legal responsibilities. The student is expected to:**
   1. compare published professional codes of ethics and scope of practice;
   2. explain principles of ethical behavior and confidentiality, including the consequences of breach of confidentiality;
   3. discuss ethical issues related to health care, including implications of technological advances;
   4. examine issues related to malpractice, negligence, and liability; and
   5. research laws governing the health science industry.

J. **The student recognizes the rights and choices of the individual. The student is expected to:**
   1. identify situations related to autonomy;
   2. identify wellness strategies for the prevention of disease;
   3. evaluate positive and negative effects of relationships on physical and emotional health such as peers,
   4. family, and friends in promoting a healthy community;
   5. review documentation related to rights and choices; and
   6. demonstrate an understanding of diversity and cultural practices influencing contemporary aspects of health care.

K. **The student recognizes the importance of maintaining a safe environment and eliminating hazardous situations. The student is expected to:**
   1. identify governing regulatory agencies such as the World Health Organization, Centers for Disease
   2. Control and Prevention, Occupational Safety and Health Administration, U.S. Food and Drug Administration, Joint Commission, and National Institute of Health;
   3. identify industry safety standards such as standard precautions, fire prevention and safety practices, and appropriate actions to emergency situations; and
   4. relate safety practices in the health science industry.

L. **The student identifies the technology used in the diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems. The student is expected to:**
   1. research and identify technological equipment used in the diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems;
   2. identify potential malfunctions of technological equipment; and
   3. recognize and explain the process for reporting equipment or technology malfunctions.

M. **The student develops technology skills. The student is expected to:**
   1. use technology as a tool to research, organize, evaluate, and communicate information.
   2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
   3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
   4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Medical Terminology/Nutrition Wellness

1. **General requirements.** This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

   B. The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

   C. The Medical Terminology course is designed to introduce students to the structure of medical terms, including prefixes, suffixes, word roots, singular and plural forms, and medical abbreviations. The course allows students to achieve comprehension of medical vocabulary appropriate to medical procedures, human anatomy and physiology, and pathophysiology.

   D. Students will participate in at least two Career Awareness Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. express ideas in a clear, concise, and effective manner; and
      2. exhibit the ability to cooperate, contribute, and collaborate as a member of a team.

   B. **The student recognizes the terminology related to the health science industry. The student is expected to:**
      1. identify abbreviations, acronyms, and symbols related to the health science industry;
      2. identify the basic structure of medical words;
      3. practice word-building skills;
      4. research the origins of eponyms;
      5. recall directional terms and anatomical planes related to body structure;
      6. define and accurately spell occupationally specific terms such as those relating to the body systems,
      7. surgical and diagnostic procedures, diseases, and treatment; and
      8. use prior knowledge and experiences to understand the meaning of terms as they relate to the health
      9. science industry.

C. **The student demonstrates communication skills using the terminology applicable to the health science industry. The student is expected to:**
   1. demonstrate appropriate verbal and written strategies such as correct pronunciation of medical terms
   2. and spelling in a variety of health science scenarios;
   3. employ increasingly precise language to communicate; and
   4. translate technical material related to the health science industry.

D. **The student examines available resources. The student is expected to:**
   1. examine medical and dental dictionaries and multimedia resources;
   2. integrate resources to interpret technical materials; and
   3. investigate electronic media with appropriate supervision.

E. **The student interprets medical abbreviations. The student is expected to:**
   1. distinguish medical abbreviations used throughout the health science industry; and
   2. translate medical abbreviations in simulated technical material such as physician progress notes,
   3. radiological reports, and laboratory reports.

F. **The student appropriately translates health science industry terms. The student is expected to:**
   1. interpret, transcribe, and communicate vocabulary related to the health science industry;
   2. translate medical terms to conversational language to facilitate communication;
   3. distinguish medical terminology associated with medical specialists such as geneticists, pathologists, and
   4. oncologists;
   5. summarize observations using medical terminology; and
   6. interpret contents of medical scenarios correctly.

G. **The student develops technology skills. The student is expected to:**
   1. Use technology as a tool to research, organize, evaluate, and communicate information.
   2. Use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools,
   3. and social networks appropriately to access, manage; integrate, evaluate, and create information to
   4. successfully function in a knowledge economy;
   5. Demonstrate using current and new technologies specific to the program of study, course; and/or
   6. industry; and
   7. Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Anatomy and Physiology

1. **General requirements.** This course is recommended for students in Grades 11-12. Prerequisite: Medical Terminology. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

   B. The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

   C. The Anatomy and Physiology course is designed for students to conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Anatomy and Physiology will study a variety of topics, including the structure and function of the human body and the interaction of body systems for maintaining homeostasis.

   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which might include paid or unpaid internship experiences relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and
      2. exhibit the ability to cooperate, contribute, and collaborate as a member of a team.

   B. **The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:**
      1. demonstrate safe practices during laboratory and field investigations; and
      2. demonstrate an understanding of the use and conservation of resources and the proper disposal or
         1. recycling of materials.

   C. **The student uses scientific methods and equipment during laboratory and field investigations.**
      1. **The student is expected to:**
      2. know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;

3. know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;
4. know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science are created and new technologies emerge;
5. distinguish between scientific hypotheses and scientific theories;
6. plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;
7. collect and organize qualitative and quantitative data and make measurements with accuracy and
8. precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettes, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;
9. analyze, evaluate, make inferences, and predict trends from data; and
10. communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

D. **The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:**
   1. in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking;
   2. communicate and apply scientific information extracted from various sources such as accredited scientific journals, institutions of higher learning, current events, news reports, published journal articles, and marketing materials;
   3. draw inferences based on data related to promotional materials for products and services;
   4. evaluate the impact of scientific research on society and the environment;
   5. evaluate models according to their limitations in representing biological objects or events; and
   6. research and describe the history of science and contributions of scientists.

E. **The student evaluates the energy needs of the human body and the processes through which these needs are fulfilled. The student is expected to:**
   1. analyze the chemical reactions that provide energy for the body;
   2. evaluate the modes, including the structure and function of the digestive system, by which energy is processed and stored within the body;
   3. analyze the effects of energy deficiencies in malabsorption disorders as they relate to body systems such as Crohn's disease and cystic fibrosis; and
   4. analyze the effects of energy excess in disorders as they relate to body systems such as cardiovascular, endocrine, muscular, skeletal, and pulmonary.

F. **The student differentiates the responses of the human body to internal and external forces.**
   1. **The student is expected to:**
   2. explain the coordination of muscles, bones, and joints that allows movement of the body;
   3. investigate and report the uses of various diagnostic and therapeutic technologies;
   4. interpret normal and abnormal contractility conditions such as in edema, glaucoma, aneurysms, and hemorrhage;
   5. analyze and describe the effects of pressure, movement, torque, tension, and elasticity on the human body; and
   6. perform an investigation to determine causes and effects of force variance and communicate findings.

G. **The student examines the body processes that maintain homeostasis. The student is expected to:**
   1. investigate and describe the integration of the chemical and physical processes, including equilibrium, temperature, pH balance, chemical reactions, passive transport, active transport, and biofeedback, that contribute to homeostasis; and
   2. determine the consequences of the failure to maintain homeostasis.

H. **The student examines the electrical conduction processes and interactions. The student is expected to:**
   1. illustrate conduction systems such as nerve transmission or muscle stimulation;
   2. investigate the therapeutic uses and effects of external sources of electricity on the body system; and
   3. evaluate the application of advanced technologies such as electroencephalogram, electrocardiogram,
   4. bionics, transcutaneous electrical nerve stimulation, and cardioversion.

I. **The student explores the body's transport systems. The student is expected to:**
   1. analyze the physical, chemical, and biological properties of transport systems, including circulatory, respiratory, and excretory;
   2. determine the factors that alter the normal functions of transport systems; and
   3. contrast the interactions among the transport systems.

J. **The student investigates environmental factors that affect the human body. The student is expected to:**
   1. identify the effects of environmental factors such as climate, pollution, radioactivity, chemicals, electromagnetic fields, pathogens, carcinogens, and drugs on body systems; and
   2. explore measures to minimize harmful environmental factors on body systems.

K. **The student investigates the structure and function of the human body. The student is expected to:**
   1. analyze the relationships between the anatomical structures and physiological functions of systems, including the integumentary, nervous, skeletal, muscular, cardiovascular, respiratory, digestive, urinary, immune, endocrine, and reproductive systems;
   2. evaluate the cause and effect of disease, trauma, and congenital defects on the structure and function of cells, tissues, organs, and systems;
   3. research technological advances and limitations in the treatment of system disorders; and
   4. examine characteristics of the aging process on body systems.

L. **The student describes the process of reproduction and growth and development. The student is expected to:**
   1. explain embryological development of cells, tissues, organs, and systems;
   2. identify the functions of the male and female reproductive systems; and
   3. summarize the human growth and development cycle.

M. **The student recognizes emerging technological advances in science. The student is expected to:**
   1. recognize advances in stem cell research such as cord blood use; and
   2. recognize advances in bioengineering and transplant technology.

N. **The student develops technology skills. The student is expected to:**
   1. use technology as a tool to research, organize, evaluate, and communicate information.
   2. use digital technologies (computers, pdas, media players, gps, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
   3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
   4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Medical Microbiology

1. **General requirements.** This course is recommended for students in Grade 12. Prerequisite: Health Science Theory and Practice. Students must meet the 40% laboratory and fieldwork requirement. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.
   C. The Medical Microbiology course is designed to explore the microbial world, studying topics such as pathogenic and non-pathogenic microorganisms, laboratory procedures, identifying microorganisms, drug resistant organisms, and emerging diseases.
   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which includes paid or unpaid internship, pre-apprenticeship, or apprenticeship experiences relevant to the program of study.
   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and
      2. exhibit the ability to cooperate, contribute, and collaborate as a member of a team.

   B. **The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:**
      1. demonstrate safe practices during laboratory and field investigations; and
      2. demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

   C. **The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:**
      1. know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;
      2. know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;
      3. know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-

reliable explanations, but they may be subject to change as new areas of science are created and new technologies emerge;
4. distinguish between scientific hypothesis and scientific theories;
5. plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;
6. collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;
7. analyze, evaluate, make inferences, and predict trends from data;
8. communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;
9. dispose of all biological material in the proper biohazard containers; and
10. employ standard precautions, including proper protective equipment during all laboratory exercises.

D. **The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:**
1. in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking;
2. communicate and apply scientific information extracted from various sources such as accredited scientific journals, institutions of higher learning, current events, news reports, published journal articles, and marketing materials;
3. draw inferences based on data related to promotional materials for products and services;
4. evaluate the impact of scientific research on society and the environment;
5. evaluate models according to their limitations in representing biological objects or events; and
6. research and describe the history of science and contributions of scientists.

E. **The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:**
1. research and describe the historical development of microbiology as it relates to health care of an individual; and
2. research roles, functions, and responsibilities of agencies governing infectious disease control.

F. **The student is expected to perform and analyze results in the microbiology laboratory. The student is expected to:**
1. classify microorganisms using a dichotomous key;
2. explain the difference between Gram positive and Gram negative bacteria regarding the bacterial cell wall;
3. identify chemical processes of microorganisms;
4. recognize the factors required for microbial reproduction and growth;
5. identify the normal flora microorganisms of the human body;

6. distinguish between pathogens, opportunistic pathogens, hospital-acquired infections, and colonizing microorganisms;
7. describe the colony morphology of microorganisms;
8. interpret Gram stain results;
9. discuss the results of laboratory procedures such as biochemical reactions that are used to identify microorganisms; and
10. explain the role of the sensitivity report provided to the clinician by the microbiology department.

G. **The student examines the role of microorganisms in infectious diseases. The student is expected to:**
1. outline the infectious process, including how pathogenic microorganisms affect human body systems;
2. categorize diseases caused by bacteria, fungi, viruses, protozoa, rickettsias, arthropods, and helminths;
3. explain the body's immune response and defenses against infection;
4. evaluate the effects of anti-microbial agents such as narrow and broad spectrum antibiotics;
5. examine reemergence of diseases such as malaria, tuberculosis, and polio;
6. identify common bacterial infections from hospital-acquired infection and community-acquired infections such as *Clostridium difficile* and *Staphylococcus aureus*;
7. investigate drug-resistant microorganisms such as carbapenem-resistant *Enterobacteriaceae*, methicillin-resistant *Staphylococcus aureus*, vancomycin-intermediate/resistant *Staphylococci aureus*, vancomycin-resistant enterococci, and emergent antibiotic-resistant superbugs; and
8. outline the role of the governing agencies in monitoring and establishing guidelines based on the spread of infectious diseases.

H. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information.
2. use digital technologies (computers, pdas, media players, gps, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.