Webb's Depth of Knowledge (DOK)
for Agricultural and Environmental Systems

1 - Low 4 - High

Standard/Outcome/Competency		DOK Level
Strand 1: Business Operations/21st Century Skills		
Outcome 1.1. REQUIRED Employability Skills: Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.		2
1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.		1
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.		1
1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.		2
1.1.4. Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.		2
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, resumé writing, interviewing skills, portfolio development).		2
1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.		2
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.		2
1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.		1
1.1.9. Give and receive constructive feedback to improve work habits.		3
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.		3
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.		2
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.		1
Outcome 1.1. DOK Frequency	**Level 1:**	4
	Level 2:	6
	Level 3:	2
	Level 4:	0
Outcome 1.2. REQUIRED Leadership and Communications: Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.		2
1.2.1. Extract relevant, valid information from materials and cite sources of information.		1
1.2.2. Deliver formal and informal presentations.		2
1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.		2
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.		3

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.		2
1.2.6. Use proper grammar and expression in all aspects of communication.		1
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.		2
1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.		2
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).		1
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.		4
1.2.11. Write professional correspondence, documents, job applications and resumés.		2
1.2.12. Use technical writing skills to complete forms and create reports.		2
1.2.13. Identify stakeholders and solicit their opinions.		3
1.2.14. Use motivational strategies to accomplish goals.		2
Outcome 1.2. DOK Frequency	**Level 1:**	3
	Level 2:	8
	Level 3:	2
	Level 4:	1
Outcome 1.3. REQUIRED Business Ethics and Law: Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.		2
1.3.1. Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.		3
1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.		2
1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).		2
1.3.4. Identify how federal and state consumer protection laws affect products and services.		1
1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.		2
1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.		1
1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC]).		2
1.3.8. Verify compliance with computer and intellectual property laws and regulations.		2
1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.		2
Outcome 1.3. DOK Frequency	**Level 1:**	2
	Level 2:	6
	Level 3:	1
	Level 4:	0
Outcome 1.4. REQUIRED Knowledge Management and Information Technology: Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business		2

operations.		
1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).		2
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).		2
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.		2
1.4.4. Use system hardware to support software applications.		2
1.4.5. Use information technology tools to maintain, secure and monitor business records.		2
1.4.6. Use an electronic database to access and create business and technical information.		2
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).		2
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.		2
Outcome 1.4. DOK Frequency	**Level 1:**	0
	Level 2:	8
	Level 3:	0
	Level 4:	0
Outcome 1.5. REQUIRED Global Environment: Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.		2
1.5.1. Describe how cultural understanding, cultural intelligence skills and continual awareness are interdependent.		1
1.5.2. Describe how cultural intelligence skills influence the overall success and survival of an organization.		1
1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.		2
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.		2
1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.		2
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.		3
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.		2
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.		2
Outcome 1.5. DOK Frequency	**Level 1:**	2
	Level 2:	5
	Level 3:	1
	Level 4:	0
Outcome 1.6. REQUIRED Business Literacy: Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.		2
1.6.1. Identify business opportunities.		1
1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk versus reward, reasons for success and failure).		2
1.6.3. Explain the importance of planning your business.		1
1.6.4. Identify types of businesses, ownership and entities (i.e., individual proprietorships, partnerships, corporations, cooperatives, public, private, profit, not-for-profit).		2
1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments and interdepartmental interactions.		2
1.6.6. Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.		1
1.6.7. Identify the effect of supply and demand on products and services.		1

1.6.8. Identify the features and benefits that make an organization's product or service competitive.		1
1.6.9. Explain how the performance of an employee, a department and an organization is assessed.		2
1.6.10. Describe the impact of globalization on an enterprise or organization.		2
1.6.11. Describe how all business activities of an organization work within the parameters of a budget.		2
1.6.12. Describe classifications of employee benefits, rights, deductions and compensations.		2
Outcome 1.6. DOK Frequency	**Level 1:**	5
	Level 2:	7
	Level 3:	0
	Level 4:	0
Outcome 1.7. OPTIONAL Entrepreneurship/Entrepreneurs: Analyze the environment in which a business operates and the economic factors and opportunities associated with self-employment.		2
1.7.1. Compare and contrast the four types of business ownership (i.e., individual proprietorships, partnerships, corporations, cooperatives).		2
1.7.2. Explain the role of profit as the incentive to entrepreneurs in a market economy.		1
1.7.3. Identify the factors that contribute to the success and failure of entrepreneurial ventures.		1
1.7.4. Assess the roles of nonprofit and for-profit businesses.		2
1.7.5. Develop a business plan.		2
1.7.6. Describe life cycles of an entrepreneurial business and an entrepreneur.		2
1.7.7. Create a list of personal strengths, weaknesses, skills and abilities needed to be successful as an entrepreneur.		2
1.7.8. Explain pathways used to become an entrepreneur.		2
1.7.9. Conduct a self-assessment to determine entrepreneurial potential.		2
1.7.10. Describe techniques for obtaining experience (e.g., apprenticeship, co-operative [co-op] education, work placement, internship, job shadowing) related to an entrepreneurial objective.		2
1.7.11. Identify initial steps in establishing a business (e.g., limited liability company [LLC], tax ID, permits, insurance, licensing).		1
1.7.12. Identify resources available to entrepreneurs (e.g., Small Business Administration, mentors, information resources, educational opportunities).		2
1.7.13. Protect intellectual property and knowledge (e.g., copyright, patent, trademark, trade secrets, processes).		2
Outcome 1.7. DOK Frequency	**Level 1:**	3
	Level 2:	10
	Level 3:	0
	Level 4:	0
Outcome 1.8. OPTIONAL Operations Management: Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.		3
1.8.1. Forecast future resources and budgetary needs using financial documents (e.g., balance sheet, demand forecasting, financial ratios).		3
1.8.2. Select and organize resources to develop a product or a service.		3
1.8.3. Analyze the performance of organizational activities and reallocate resources to achieve established goals.		2
1.8.4. Identify alternative actions to take when goals are not met (e.g., changing goals, changing strategies, efficiencies).		2
1.8.5. Use inventory and control systems to purchase materials, supplies and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).		3
1.8.6. Identify the advantages and disadvantages of carrying cost and Just-in-Time (JIT) production systems and the effects of maintaining inventory (e.g., perishable, shrinkage, insurance) on profitability.		2
1.8.7. Collect information and feedback to help assess the organization's strategic planning and		

policymaking processes.		4
1.8.8. Identify routine activities for maintaining business facilities and equipment.		1
1.8.9. Develop a budget that reflects the strategies and goals of the organization.		2
1.8.10. Analyze how business management and environmental management systems (e.g., health, safety) contribute to continuous improvement and sustainability.		3
Outcome 1.8. DOK Frequency	**Level 1:**	1
	Level 2:	4
	Level 3:	4
	Level 4:	1
Outcome 1.9. REQUIRED Financial Management: Use financial tools, strategies and systems to develop, monitor and control the use of financial resources to ensure personal and business financial well-being.		2
1.9.1. Create, analyze and interpret financial documents (e.g., budgets, income statements).		3
1.9.2. Identify tax obligations.		1
1.9.3. Review and summarize savings, investment strategies and purchasing options (e.g., cash, lease, finance, stocks, bonds).		2
1.9.4. Identify credit types and their uses in order to establish credit.		1
1.9.5. Identify ways to avoid or correct debt problems.		1
1.9.6. Explain how credit ratings and the criteria lenders use to evaluate repayment capacity affect access to loans.		2
1.9.7. Review and summarize categories (types) of insurance and identify how insurances can reduce financial risk.		2
1.9.8. Identify income sources and expenditures.		1
1.9.9. Compare and contrast different banking services available through financial institutions.		2
1.9.10. Identify the role of depreciation in tax planning and liability.		1
Outcome 1.9. DOK Frequency	**Level 1:**	5
	Level 2:	4
	Level 3:	1
	Level 4:	0
Outcome 1.10. OPTIONAL Sales and Marketing: Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.		2
1.10.1. Identify how the roles of sales, advertising and public relations contribute to a company’s brand.		1
1.10.2. Determine the customer's needs and identify solutions.		2
1.10.3. Communicate features, benefits and warranties of a product or service to the customer.		2
1.10.4. Identify the company policies and procedures for initiating product and service improvements.		1
1.10.5. Monitor customer expectations and determine product/service satisfaction by using measurement tools.		3
1.10.6. Discuss the importance of correct pricing to support a product’s or service’s positioning in the marketing mix.		2
1.10.7. Describe the importance and diversity of distribution channels (i.e., direct, indirect) to sell a product.		1
1.10.8. Use promotional techniques to maximize sales revenues (e.g., advertising, sales promotions, publicity, public relations).		2
1.10.9. Describe how product mix (e.g., product line, product items) maximizes sales revenues, market, share and profit margin.		1
1.10.10. Demonstrate sales techniques.		2
Outcome 1.10. DOK Frequency	**Level 1:**	4
	Level 2:	5

	Level 3:	1
	Level 4:	0
Outcome 1.11. OPTIONAL Principles of Business Economics: Examine and employ economic principles, concepts and policies to accomplish organizational goals and objectives.		2
1.11.1. Identify the economic principles that guide geographic location of an industry's facilities (e.g., relative scarcity, price, quantity of products and services).		2
1.11.2. Identify the difference between monetary and nonmonetary incentives and explain how changes in incentives cause changes in behavior.		2
1.11.3. Use economic indicators to identify economic trends and conditions (e.g., inflation, interest rate fluctuations, unemployment rates).		2
1.11.4. Determine how the quality, quantity and pricing of goods and services are affected by domestic and international competition in a market economy.		3
1.11.5. Analyze factors that affect currency and exchange rates.		3
1.11.6. Explain how financial markets and government policies influence interest rates (credit ratings/debt ceiling), trade deficits and unemployment.		2
1.11.7. Describe how economic performance and culture are interdependent.		1
1.11.8. Identify the relationships between economy, society and environment that lead to sustainability.		1
1.11.9. Describe how laws and regulations influence domestic and international trade.		2
Outcome 1.11. DOK Frequency	**Level 1:**	2
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 1.12. OPTIONAL Site and Personal Safety Procedures: Follow site and personal safety procedures in specific situations with specialized tools and equipment, evaluate the situation and take corrective action.		2
1.12.1. Use Occupational Safety and Health Administration (OSHA) defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.		2
1.12.2. Interpret safety signs and symbols.		1
1.12.3. Interpret personal safety rights according to the employee Right to Know plan.		1
1.12.4. Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.		2
1.12.5. Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.		1
1.12.6. Identify procedures for the handling, storage and disposal of hazardous materials.		1
1.12.7. Select, use, store, maintain and dispose of personal protective equipment (PPE), appropriate to job tasks, conditions and materials.		2
1.12.8. Identify safety hazards and take corrective measures.		2
1.12.9. Identify, inspect and use safety equipment appropriate for the task.		2
1.12.10. Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary.		2
1.12.11. Set up for ergonomic workflow.		3
1.12.12. Apply inspection, rejection criteria, hitch configurations and load handling practices to slings and rigging hardware.		3
1.12.13. Demonstrate the proper use of American National Standards Institute (ANSI) hand signals.		2
1.12.14. Identify the source of electrical hazards and use shutdown and established lock-out/tag-out procedures.		1
1.12.15. Select and operate fire extinguishers based on the class of fire.		2

1.12.16. Describe the interactions of incompatible substances when measuring and mixing chemicals.		1
1.12.17. Identify symptoms of exposure to health-threatening environments (e.g., temperature; chemical noise, vibration, harshness [NVH] hazards).		2
Outcome 1.12. DOK Frequency	**Level 1:**	6
	Level 2:	9
	Level 3:	2
	Level 4:	0
Strand 1. DOK Frequency	**Level 1:**	37
	Level 2:	88
	Level 3:	17
	Level 4:	2
Strand 2: Animal Science		
Outcome 2.1. Nutrition: Analyze, formulate, prepare and administer a ration for a population of specific animal species based on the economics, nutrition and availability of feed and evaluate the feed's effects on animals.		2
2.1.1. Identify the traditional and alternative types, compositions, quality and compatibility of feeds, feed additives and feed byproducts.		2
2.1.2. Determine the role of nutrients and the nutritional requirements of different animal life processes and species.		2
2.1.3. Analyze the nutritional content and quality of feeds.		2
2.1.4. Identify and address major nutrient deficiency and toxicity symptoms.		1
2.1.5. Identify and describe biological and non-biological contaminants found in feedstuffs and their impacts on animals.		1
2.1.6. Determine feed efficiency and value in relation to the cost, quality and availability of feeds.		2
2.1.7. Formulate and prepare rations and diets for production, specialty markets and special diets.		1
2.1.8. Select and implement feeding and watering practices and systems, based on the animal population and purpose.		3
Outcome 2.1. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	1
	Level 4:	0
Outcome 2.2. Body Systems: Describe the interrelationships of animal body systems with growth, development, health, maintenance, reproduction and economic production.		2
2.2.1. Describe external anatomical parts and their functions.		1
2.2.2. Identify the anatomical parts of the digestive system and describe their physiology.		1
2.2.3. Identify anatomical components of nerve tissue and the nervous system, including regions of the brain, spinal nerves and the sympathetic and parasympathetic system, and describe their physiology.		2
2.2.4. Identify the anatomical components of the skeletal system, including the types and forms of bones, and describe their physiology.		1
2.2.5. Identify the anatomy of the musculature systems, including striated, cardiac and smooth muscle, and describe their physiology.		1
2.2.6. Compare and contrast bone growth, muscle growth and fat deposition in relation to developmental patterns.		2
2.2.7. Describe the physical characteristics, components and functions of blood.		1
2.2.8. Describe the components of the cardiovascular system and their functions, including factors affecting blood flow.		1
2.2.9. Describe the integumentary system (e.g., skin, hair, nails, wool, feathers), related structures and functions.		1

2.2.10. Describe the function and components of the respiratory system and pulmonary ventilation and the factors influencing respiratory rates.		1
2.2.11. Describe the urinary system structures and functions, including excretion and osmoregulation.		1
2.2.12. Differentiate between the male and female reproductive system, structures and functions.		2
2.2.13. Describe the endocrine system, its structures and the role of hormones.		1
2.2.14. Describe the immune system and the lymphatic system's role in immunity.		2
2.2.15. Identify the anatomy and describe the physiology of the mammary system.		1
Outcome 2.2. DOK Frequency	**Level 1:**	11
	Level 2:	4
	Level 3:	0
	Level 4:	0
Outcome 2.3. Care and Management: Apply animal care and management procedures to ensure animal husbandry and welfare, including managing environmental conditions to ensure animal health and performance.		2
2.3.1. Identify species-specific terminology based on gender and age.		1
2.3.2. Identify, classify, evaluate and select animal species or breeds for a desired outcome.		2
2.3.3. Determine the biotic and abiotic factors (e.g., air, ventilation) that impact the animals' environment.		1
2.3.4. Apply concepts of pest control, sanitation and disinfection procedures for the animals' care and management.		2
2.3.5. Perform species-specific animal identification techniques (e.g., chipping, tagging, branding, notching, tattooing).		1
2.3.6. Use identification techniques for record keeping and traceability.		1
2.3.7. Estimate an operation's or environment's carrying capacity and its impact on animal health.		3
2.3.8. Identify and recognize predator-prey relationships and implement control measures.		1
2.3.9. Evaluate and perform animal care procedures throughout the life of the animal.		3
2.3.10. Monitor and evaluate the quality of an animal's habitat and implement corrective methods as needed.		2
2.3.11. Recognize common restraints and tack devices, including their use and adjustment.		1
2.3.12. Groom animals through brushing and bathing.		1
2.3.13. Assess the nails and hooves of animals and understand the practice of trimming and treating for specific species.		1
2.3.14. Compare and contrast different breed standards of grooming and styling techniques for specific animal breeds and species.		3
Outcome 2.3. DOK Frequency	**Level 1:**	8
	Level 2:	3
	Level 3:	3
	Level 4:	0
Outcome 2.4. Recognizing Diseases and Disorders: Evaluate animal conditions for species-specific diseases and disorders to assess an animal's health and welfare.		2
2.4.1. Identify general infectious and noninfectious causes of diseases and disorders.		1
2.4.2. Examine an animal to evaluate its general condition.		2
2.4.3. Investigate and appraise signs of pain, distress, allergic reactions and lameness.		1
2.4.4. Assess genetic abnormalities in the skeleton, body form and body functions and identify the symptoms associated.		2
2.4.5. Explain the symptoms that are associated with an abnormality caused by environmental factors.		2
2.4.6. Assess symptoms of animals to identify diseases caused by a microorganism (e.g., parasite, virus, bacteria, fungi, protozoa).		2
2.4.7. Identify and describe zoonotic diseases.		2

2.4.8. Explain the health risk of zoonotic diseases on humans and their historical significance and future implications.		3
2.4.9. Implement disease prevention methods and procedures.		2
2.4.10. Collect and prepare voided specimens and perform urinalysis and fecal floatation with centrifugation.		2
2.4.11. Produce diagnostic radiographs using x-ray equipment and image receptors.		3
2.4.12. Apply principles of image physics and perform ultrasound techniques.		3
2.4.13. Determine types of immunity and immune responses and simulate the administration of species-specific immunizations to maintain overall health.		2
2.4.14. Identify and recognize normal and abnormal dental structures and conditions.		1
Outcome 2.4. DOK Frequency	**Level 1:**	3
	Level 2:	8
	Level 3:	3
	Level 4:	0
Outcome 2.5. Animal Health: Implement preventive measures, treatment and maintenance options for species-specific diseases and disorders to improve an animal's health and welfare.		3
2.5.1. Obtain and interpret an animal's vitals.		2
2.5.2. Apply concepts of body condition scoring to assess an animal's general health and nutrition status.		3
2.5.3. Recognize the preventative measures or treatments needed to maintain animal health.		1
2.5.4. Apply basic principles of first-aid.		2
2.5.5. Inventory, store and dispose of pharmaceutical drugs by category, class and label.		2
2.5.6. Describe the routes of administration for medications and the process of drug absorption, distribution, metabolism, withdrawal and excretion.		3
2.5.7. Interpret and follow label directions for the dosage, route of administration and withdrawal period.		1
2.5.8. Simulate the administration of drug treatments and vaccines, following quality assurance guidelines, and monitor common adverse effects and potential problems associated with administration.		3
2.5.9. Prepare a sterile surgical environment, prepare patients for surgery and conduct post-operative procedures.		3
2.5.10. Describe advantages, disadvantages and adverse side effects of commonly used preanesthetic and anesthetic agents.		2
Outcome 2.5. DOK Frequency	**Level 1:**	2
	Level 2:	4
	Level 3:	4
	Level 4:	0
Outcome 2.6. Population Management: Manage reproduction practices in animal populations across habitats to achieve the desired outcomes and specific goals.		3
2.6.1. Identify factors that lead to reproductive maturity and select animals for reproductive readiness.		1
2.6.2. Compare and select superior individuals based on phenotype.		2
2.6.3. Compare and select superior individuals based on breeding values and heritability of the desired traits.		3
2.6.4. Determine the factors that influence estrus, gestation and parturition and employ appropriate management practices.		1
2.6.5. Manipulate an animal's reproductive processes to support breeding (e.g., sex-sorted semen, heat synchronization, nutritional flushing, light cycling).		3
2.6.6. Evaluate and employ breeding methods (e.g., artificial insemination, embryo transfer, natural selection, selective breeding, invitro fertilization, cloning).		3
2.6.7. Describe nutritional and environmental influences during different stages of gestation.		2
2.6.8. Describe ethical and responsible animal population management practices (e.g., spaying, neutering,		

birth control, relocation, reintroduction, hunting, containment, culling, euthanasia).		3
Outcome 2.6. DOK Frequency	**Level 1:**	2
	Level 2:	2
	Level 3:	4
	Level 4:	0
Outcome 2.7. Animal Behavior: Apply management practices to assure quality animal care, considering species-specific behaviors, human safety, social influences, public perception and regulations associated with animal welfare.		2
2.7.1. Understand social influences, public perception and regulations that are associated with animal welfare.		1
2.7.2. Describe the adaptations and special senses (e.g., sight, hearing, smell, touch) of animals and how they contribute to animal behavior.		1
2.7.3. Identify and describe the innate behavioral patterns of animals.		1
2.7.4. Identify social relationships involved in behavioral adjustment and adaptation (e.g., animal-to-animal and human-to-animal interaction).		2
2.7.5. Interpret an animal's intent based on its vocalization, body posture and chemical means of communication.		3
2.7.6. Recognize behavior abnormalities and employ corrective action.		2
2.7.7. Handle, restrain and move animals, while ensuring the safety of the animals and their handlers.		2
Outcome 2.7. DOK Frequency	**Level 1:**	3
	Level 2:	3
	Level 3:	1
	Level 4:	0
Strand 2. DOK Frequency	**Level 1:**	32
	Level 2:	33
	Level 3:	18
	Level 4:	0
Strand 3: Biotechnology		
Outcome 3.1. Handling, Preparation, Transportation, Storage and Disposal: Handle, prepare, transport, store and dispose of specimens using procedures that minimize disturbance to the test specimen. Monitor, record and maintain the integrity of equipment and instrumentation, environmental conditions of the facility and the inventory.		2
3.1.1. Prepare and interpret labels for chemicals, supplies and equipment.		1
3.1.2. Use chemical references to identify hazards associated with handling and storing chemicals.		1
3.1.3. Neutralize acids, bases or caustic solutions for handling and disposal.		2
3.1.4. Sample, monitor and record the environmental conditions of the facility (e.g., air quality, temperature, microbial contaminations).		1
3.1.5. Describe the purpose of common laboratory equipment.		2
3.1.6. Identify when to use high-efficiency particulate air (HEPA) filters and biological safety cabinets.		2
3.1.7. Select personal protective attire for various laboratory protocols.		2
3.1.8. Differentiate between primary and secondary barriers.		1
3.1.9. Use laboratory biosafety level criteria, based on established standard operating procedures.		2
3.1.10. List basic characteristics of each of the four biosafety levels for infectious agents and identify potential sources of infectious agents.		1
3.1.11. Adjust, calibrate and perform systems diagnostics on laboratory equipment.		3
3.1.12. Maintain equipment logs and determine when to perform, implement or schedule preventive maintenance and systems updates.		3

3.1.13. Verify expiration dates and lot numbers.		1
3.1.14. Implement a chemical inventory system that includes all pertinent information regarding stability, hazards and sensitivity.		2
3.1.15. Maintain an inventory system for products.		1
3.1.16. Implement procedures to monitor the distribution, consumption and pilferage of materials.		2
3.1.17. Maintain separate in-processing, quarantine and release areas.		3
Outcome 3.1. DOK Frequency	**Level 1:**	7
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 3.2. Foundations of Chemistry: Perform a systematic and methodical application of general and organic chemistry principles to examine structures, their functions, their binding to other molecules and the methodologies for their purity and characterization.		2
3.2.1. Illustrate electron configurations of elements, compounds and mixtures.		2
3.2.2. Use the periodic table to describe atomic structure and to characterize molecules based on functional groups.		1
3.2.3. Differentiate between organic and inorganic compounds.		1
3.2.4. Use common and chemical nomenclature for organic and inorganic materials.		1
3.2.5. Write names and formulas for common compounds.		1
3.2.6. Prepare solutions based on molarity, normality, percent weight per volume (w/v) and percent volume per volume (v/v).		2
3.2.7. Describe chemical bonding and bond types, including ionic and covalent and the relationships that they have with the physical state of materials.		2
3.2.8. Apply the concepts of stoichiometry and the laws of thermodynamics to chemical reactions.		3
3.2.9. Balance chemical reactions.		3
3.2.10. Identify materials that can be used as a catalyst.		1
3.2.11. Predict endothermic and exothermic characteristics of a chemical reaction.		2
3.2.12. Use naming systems, including common and International Union of Pure and Applied Chemistry (IUPAC) conventions.		1
3.2.13. Use and calibrate precision weighing and measuring techniques (e.g., analytical balance, micropipette), based on the metric system.		2
3.2.14. Calibrate volumetric glassware (e.g., pipettes, volumetric flasks and burettes).		2
3.2.15. Calculate errors in various measurements, based on data acquired using common laboratory equipment.		3
3.2.16. Apply standard rules for determining the number of significant figures in measurements and in the answers to corresponding calculations.		1
3.2.17. Convert units of measure from English to metric and within the metric system.		1
3.2.18. Calculate the volume, temperature and pressure of gases using the ideal gas law, Charles' Law and Boyle's Law.		2
Outcome 3.2. DOK Frequency	**Level 1:**	8
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 3.3. Microbiology Testing and Technology: Describe the morphologies and processes of the reproduction of microorganisms.		2
3.3.1. Use microbial taxonomy and classification systems to identify microbial organisms.		1
3.3.2. Compare and contrast cellular structure and functions of prokaryotic and eukaryotic cells.		2
3.3.3. Transform deoxyribonucleic acid (DNA) to alter bacterial metabolism, reproduction, cell structures		

and their functions.		3
3.3.4. Identify aerobic bacteria through morphological, physical and biochemical properties.		1
3.3.5. Obtain specimens for microbiological testing.		1
3.3.6. Differentiate between types of viruses.		1
3.3.7. Explain virulence, pathogenicity and the factors that contribute to pathogenicity.		2
3.3.8. Describe types and features of passive and active transport systems.		1
3.3.9. Describe molecular behavior and the structure of large molecules, including carbohydrates, lipids, proteins and nucleic acids.		2
3.3.10. Explain how chemical energy operates major cell processes (e.g., biosynthesis, movement, transport, growth).		2
3.3.11. Identify factors that affect and optimize rates of enzyme assay reactions.		2
3.3.12. Perform an enzyme-linked immunosorbent assay (ELISA) and interpret the results.		3
3.3.13. Perform biochemical assays of proteins, lipids, carbohydrates, nucleic acids and enzymes.		2
3.3.14. Perform bioassays for pathogens.		2
3.3.15. Distinguish uses and limitations of various assays.		1
3.3.16. Apply quality assurance control processes within the lab setting (e.g., pre-analytic, analytic and post-analytic sources of error).		3
3.3.17. Perform autoclave sterilization.		1
3.3.18. Explain the centrifugation process.		1
Outcome 3.3. DOK Frequency	**Level 1:**	8
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 3.4. Molecular-Genetics Technology: Apply knowledge of nucleic acid structure and function, deoxyribonucleic acid (DNA) replication, transcription, translation, chromosome structure and remodeling and regulation of gene expression in prokaryotes and eukaryotes.		3
3.4.1. Use a Punnet square to predict and explain Mendel's Laws, genotype and phenotype.		2
3.4.2. Explain alternative forms of transmission (e.g., non-Mendelian inheritance).		1
3.4.3. Model, predict and diagram the three-dimensional shape, types of bonds (covalent and hydrogen bonds) and antiparallel nature of DNA.		3
3.4.4. Model the Central Dogma Theory (e.g., replication, transcription, translation).		2
3.4.5. Follow regulations for genetic modification (e.g., histone acetylation, ribonucleic acid [RNA] stability, co- and post-translational modifications).		2
3.4.6. Identify alternative types of gene expression (e.g., sex-limited, sex-linked, partial dominance, epistatic, pleiotropic).		1
3.4.7. Identify, isolate and manipulate peptides and proteins (i.e., primary, secondary, tertiary, quaternary).		3
3.4.8. Perform the steps in creating a recombinant DNA molecule.		3
3.4.9. Isolate and purify nucleic acids, including chromosomal and extra-chromosomal DNA molecules.		2
3.4.10. Compare nucleic acids, chromosomal DNA molecules and proteins using a sequence database (e.g., National Center for Biotechnology Information, European Bioinformatics Institute).		3
3.4.11. Perform a restrictive enzyme digest and analyze the results.		3
3.4.12. Apply concepts of screening genetic expression, expression vectors and genetic libraries.		2
3.4.13. Apply the principles of nucleic acid blotting (e.g., colony transfer, Southern and Northern Blot Analysis).		2
3.4.14. Perform and interpret the results of a polymerase chain reaction (PCR).		3
3.4.15. Explain applications of Southern and Northern Blot Analysis.		2
3.4.16. Isolate, quantitate (e.g., Bradford assay) and characterize (e.g., Western Blot analysis) proteins.		3

3.4.17. Perform antibiotic resistance cloning techniques, including vector preparation, transformation and selection.		4
3.4.18. Perform spectroscopy of biological materials explaining the principles behind the procedures, the purpose of a blank and determine the concentration of biomolecular samples.		3
3.4.19. Evaluate genomes in relation to food, plant, animals and natural resources.		3
3.4.20. Perform gene analysis to determine the source of an isolated pathogen.		3
3.4.21. Identify the role of RNA in gene expression.		2
3.4.22. Explain results from genome sequencing projects and explain how gene sequencing is performed.		3
Outcome 3.4. DOK Frequency	**Level 1:**	2
	Level 2:	8
	Level 3:	11
	Level 4:	1
Outcome 3.5. Laboratory Standard Operational Procedures: Perform methods and techniques using protocols to conduct an experiment.		2
3.5.1. Use an aseptic technique to collect, prepare and test samples.		2
3.5.2. Prepare and dispense stock reagents, buffers, media and solutions by calculating concentrations, adjusting factors such as pH and selecting purification techniques and containers.		2
3.5.3. Test and maintain the integrity of stains, reagents, chemicals and mounts.		2
3.5.4. Select and apply sterilization methods for reagents, buffers, media and solutions.		2
3.5.5. 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).		3
3.5.6. Monitor physical properties of reagents, buffers, media and solutions for conductivity and resistivity, pH and turbidity and explain the significance of each.		2
3.5.7. Perform separation techniques, including chemical separations, chromatography, centrifugation, distillation and filtration and interpret the results.		3
3.5.8. Titrate liquids.		1
3.5.9. Transfer gases, liquids and solids from storage containers to equipment used in the laboratory.		1
3.5.10. Perform a chromatography separation of a given mixture of substances.		3
3.5.11. Use electrophoresis to separate nucleic acids and proteins to determine molecular weight.		2
3.5.12. 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.		2
Outcome 3.5. DOK Frequency	**Level 1:**	2
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 3.6. Culturing: Perform experimental techniques used in microbial biology to study cell growth, manipulation and evaluation.		2
3.6.1. Identify the structure of cells and the functions of their components.		1
3.6.2. Explain classification, composition and preparation of culture media and prepare media for propagation.		2
3.6.3. Identify bacteriologic methods necessary for the isolation and identification of organisms.		1
3.6.4. Operate centrifuge, microscope, compound microscope, spectrophotometer, incubator, colony counter, pipettes and other basic microbiology and analytical equipment to examine biological specimens.		2
3.6.5. Explain the principles of microscopy and process a specimen for light microscopy.		2
3.6.6. Prepare, incubate and identify colonies microscopically and macroscopically (e.g., colonial morphology, staining procedures, biochemical).		3
3.6.7. Isolate, propagate, maintain and harvest pure cell lines.		2
3.6.8. Verify culture cell lines and determine the cause or causes of culture failures.		3

3.6.9. Explain the collection and handling of fungal, mycobacterial and viral specimens.		1
3.6.10. Describe how vectors (e.g., plasmids, transposons, viruses) are used to transform host and microorganisms.		2
3.6.11. Correlate bacterial binary fission with generation time.		2
3.6.12. Describe physical factors that affect microbial growth and identify a normal bacteria population growth curve.		1
3.6.13. Conduct a shelf-life study to determine physical change and biological growth.		3
3.6.14. Conduct a thermal death time study on an organism.		3
3.6.15. Calculate values of cell concentration for both batch and continuous cultivation.		2
3.6.16. Identify hormones used to stimulate cell growth and test for antibiotic susceptibility.		1
3.6.17. Explain how cell cultures can be used to assay viability and cytotoxicity.		2
3.6.18. Demonstrate cryopreservation techniques by freezing and thawing cells.		2
Outcome 3.6. DOK Frequency	**Level 1:**	5
	Level 2:	9
	Level 3:	4
	Level 4:	0
Outcome 3.7. Bioreactor Technologies: Describe and perform bioreactor and fermentation procedures (e.g., sterilization, microfiltration).		2
3.7.1. Maintain, classify and analyze types and classes of bioreactors and associated materials.		2
3.7.2. Explain the principles and importance of sterility in industrial fermentations.		1
3.7.3. Explain the temperature/pressure relationship of saturated steam to sterilization.		2
3.7.4. Explain the effect of entrapped air on sterilization effectiveness.		1
3.7.5. Compare sterilization methods using dry heat versus moist heat.		2
3.7.6. Demonstrate sterilization by micro-filtration.		2
3.7.7. Explain the effect of suspended solids in fermentation media on sterilization effectiveness.		2
3.7.8. 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.		3
3.7.9. Describe the functions and physical properties of simple and complex carbohydrates, lipids and proteins in the fermentation process.		2
3.7.10. Describe the roles of enzymes as catalysts and the factors that affect enzyme activity in the fermentation process.		3
3.7.11. Describe the relationship of oxygen transfer rates to mass transfer.		1
3.7.12. Perform applications using benchtop fermentor and bioreactor systems.		2
3.7.13. Monitor microorganism growth and determine the viability of cells.		3
Outcome 3.7. DOK Frequency	**Level 1:**	3
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 3.8. Research and Experiments: Conduct a problem-based study, applying scientific methodology and using descriptive statistics to communicate and support predictions and conclusions.		3
3.8.1. Identify research problems and structure a statistical experiment, simulation or study related to the problem.		3
3.8.2. Design a research plan, including the significance of the problem, purpose, variables, hypotheses, objectives, methods of study and a list of materials.		3
3.8.3. Distinguish between dependent, independent and control variables in an experiment.		1
3.8.4. Establish and implement procedures for systematic collection, organization and use of data.		2
3.8.5. Select and apply sampling methods that appropriately represent the population to be studied.		2

3.8.6. Define the concepts of confidence limit and significant figures.		2
3.8.7. Document results of the experiment in a laboratory notebook, including a statement of purpose, experimental designs, observations, results, conclusions and next steps.		3
3.8.8. Compute measures of central tendency and dispersion to interpret results and draw conclusions.		2
3.8.9. Describe the relationships among variables using correlations and draw conclusions.		2
3.8.10. Create, interpret and use tabular and graphical displays and describe the data.		3
3.8.11. Draw conclusions based on observations and data analyses, recognizing that experimental results must be open to the scrutiny of others.		3
3.8.12. Prepare and present findings using scientific reports.		4
Outcome 3.8. DOK Frequency	**Level 1:**	1
	Level 2:	5
	Level 3:	5
	Level 4:	1
Strand 3. DOK Frequency	**Level 1:**	36
	Level 2:	63
	Level 3:	37
	Level 4:	2
Strand 4: Power Systems		
Outcome 4.1. Tool, Stationary and Mobile Equipment Maintenance: Inspect, clean, maintain and perform planned preventative maintenance on tools, machinery, implements and equipment.		2
4.1.1. Identify the types of hand tools, power tools and stationary equipment and describe their functions.		1
4.1.2. Ensure the presence and functionality of safety systems and hardware.		2
4.1.3. Identify potential hazards and limitations related to the use of hand tools, power tools and stationary equipment.		1
4.1.4. Maintain machinery, equipment, instrument and facility cleanliness, appearance and safety.		2
4.1.5. Inspect and service the electrical connections and lamps.		2
4.1.6. Inspect for fluid leakage, fluid levels and the condition of fluids.		1
4.1.7. Clean, lubricate and adjust machinery and equipment.		2
4.1.8. Select fluids, maintain fluid levels and replace system filters.		2
4.1.9. Inspect and maintain fluid conveyance and storage components (e.g., hoses and lines, valves, nozzles).		2
4.1.10. Inspect and replace drive belts.		2
4.1.11. Calibrate metering, monitoring and sensing equipment.		3
4.1.12. Compare alternative sources of power for equipment.		2
Outcome 4.1. DOK Frequency	**Level 1:**	3
	Level 2:	8
	Level 3:	1
	Level 4:	0
Outcome 4.2. Equipment Operations: Operate and maintain mechanical equipment and power systems.		2
4.2.1. Follow manufacturer's recommended operating procedures and adjustment specifications.		1
4.2.2. Differentiate among the functions, limitations and proper use of equipment, equipment controls and instrumentation.		2
4.2.3. Perform pre- and post-operation inspections and adjustments and report malfunctions.		2
4.2.4. Perform appropriate start-up, operating and shut-down procedures.		2
4.2.5. Select and operate the equipment and attachments needed to complete the task including levers, pedals or valves.		2
	Level 1:	1

Outcome 4.2. DOK Frequency	**Level 2:**	4
	Level 3:	0
	Level 4:	0
Outcome 4.3. Engines: Apply concepts to service components of both small and large internal combustion engines.		2
4.3.1. Assess the physical and mechanical principles of engine operation, including motion, friction and thermodynamics.		2
4.3.2. Retrieve and record stored on-board diagnostics (OBD) trouble codes and clear codes where applicable.		3
4.3.3. Locate the name plate and determine engine specifications.		1
4.3.4. Analyze, evaluate and troubleshoot an engine.		3
4.3.5. Compare and contrast two-cycle and four-cycle engines and their operating principles.		2
4.3.6. Evaluate engine head and engine block components to determine serviceability according to the manufacturer's specifications.		3
4.3.7. Remove and replace components comprising the engine block and engine head.		2
4.3.8. Employ the requirements for engine servicing to maintain emission requirements.		2
Outcome 4.3. DOK Frequency	**Level 1:**	1
	Level 2:	4
	Level 3:	3
	Level 4:	0
Outcome 4.4. Lubrication and Cooling Systems: Inspect lubrication and cooling systems operation.		2
4.4.1. Explain principles of engine lubrication and cooling.		1
4.4.2. Perform lubrication, cooling system and pressure and sensor tests.		2
4.4.3. Inspect the oil pump gears or rotors, housing, pressure relief devices and pump drive.		2
4.4.4. Inspect, test and replace the radiator, pressure cap, coolant recovery tank and hoses.		2
4.4.5. Inspect and replace engine cooling and heater system hoses.		2
4.4.6. Inspect, test and replace the thermostat and gasket.		2
4.4.7. Test, drain, flush and refill coolant and bleed the cooling system.		2
4.4.8. Inspect, remove and replace the water pump.		2
4.4.9. Inspect and test mechanical and electrical fans, fan clutches, fan shrouds and air dams.		2
Outcome 4.4. DOK Frequency	**Level 1:**	1
	Level 2:	8
	Level 3:	0
	Level 4:	0
Outcome 4.5. Fuel, Air Induction and Exhaust System: Diagnose and repair fuel, air induction and exhaust systems.		2
4.5.1. Explain principles of exhaust, intake and turbocharger design and operations.		1
4.5.2. Identify conditions of hot or cold no starting, hard starting, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, fuel consumption rate, dieseling and emissions problems.		2
4.5.3. Check fuel for contaminants and quality.		2
4.5.4. Inspect and test fuel pumps and pump control systems for pressure, regulation and volume.		2
4.5.5. Inspect and test the cold enrichment system and components.		2
4.5.6. Inspect the throttle body, air induction system, intake manifold and gaskets for vacuum leaks and unmetered air.		1
4.5.7. Inspect and service governor systems.		2
4.5.8. Explain fuel injection theory.		1

4.5.9. Inspect and test fuel injectors.		2
4.5.10. Inspect the integrity of the exhaust system components.		1
4.5.11. Perform an exhaust system backpressure test.		2
4.5.12. Understand and explain exhaust gas recirculation and exhaust gas treatment systems and methods.		2
4.5.13. Identify positive crankcase ventilation systems.		1
4.5.14. Identify the parts and functions of evaporative emissions controls systems.		1
4.5.15. Check and refill the diesel exhaust fluid (DEF) and service the diesel particulate filter (DPF).		1
Outcome 4.5. DOK Frequency	**Level 1:**	7
	Level 2:	8
	Level 3:	0
	Level 4:	0
Outcome 4.6. Ignition System: Perform ignition system diagnosis and repair.		2
4.6.1. Explain basic ignition system theory.		1
4.6.2. Use wiring diagrams and schematics to troubleshoot and repair ignition system components		3
4.6.3. Diagnose and repair ignition system problems, including poor drivability, spark knock, excessive fuel consumption, power loss and emissions concerns, on vehicles with electronic and distributor ignition systems.		2
4.6.4. Identify and repair causes of start failures.		2
4.6.5. Identify and repair the causes of surging, rough operation, misfiring, low power, slow deceleration, slow acceleration and shutdown problems.		2
4.6.6. Inspect and test ignition primary and secondary circuit wiring and solid state components.		3
4.6.7. Check and adjust ignition system timing, timing advance and retard.		2
4.6.8. Inspect and test ignition system pickup sensor or triggering devices.		2
Outcome 4.6. DOK Frequency	**Level 1:**	1
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 4.7. Transmission of Power: Diagnose and service power train components.		3
4.7.1. Describe the features, benefits and applications of mechanical power transmission components (e.g., belts, chains, gears, bearings, universals).		1
4.7.2. Describe the physical and mechanical principles of mechanical, hydraulic, pneumatic and electrical power transfer.		1
4.7.3. Describe the features, benefits and applications of mechanical, hydraulic, pneumatic and electrical transmission.		1
4.7.4. Perform calculations involving speed, torque and power relationships.		2
4.7.5. Test and diagnose hydrostatic transmissions.		3
4.7.6. Test and diagnose differentials and final drives.		3
4.7.7. Test and diagnose clutches and brakes.		3
4.7.8. Test and diagnose gear-type transmissions, including power shift, synchronized and sliding gear.		3
4.7.9. Test and diagnose electronic power train control systems and programmable parameters.		3
4.7.10. Test and diagnose pneumatics.		3
4.7.11. Test and diagnose auxiliary drives.		3
4.7.12. Replace damaged and non-functioning power train components.		2
4.7.13. Select and replace drivetrain fluids and filters.		2
Outcome 4.7. DOK Frequency	**Level 1:**	3
	Level 2:	3
	Level 3:	7

	Level 4:	0
Outcome 4.8. Starting and Charging Systems: Identify, inspect and repair starting and charging system components.		2
4.8.1. Differentiate between electrical and engine mechanical problems that cause a slow crank or no crank condition.		1
4.8.2. Use wiring diagrams and schematics to troubleshoot and repair starting and charging system components.		3
4.8.3. Inspect, test and replace relays and solenoids.		3
4.8.4. Perform charging system output tests to identify causes of undercharge, no charge and overcharge conditions.		2
4.8.5. Inspect and repair alternator drive belts, pulleys and tensioners and check pulley and belt alignment.		2
4.8.6. Remove, inspect and install an alternator and starter.		2
Outcome 4.8. DOK Frequency	**Level 1:**	1
	Level 2:	3
	Level 3:	2
	Level 4:	0
Outcome 4.9. Steering, Suspension and Traction: Diagnose and repair steering, suspension and traction systems.		2
4.9.1. Evaluate traction, ballasting and weight transfer on power equipment, including towing and trailering systems.		3
4.9.2. Evaluate and formulate solutions for vehicle stability to include automatic leveling devices, center of gravity, roll-over potential and wheel base dimensions.		3
4.9.3. Remove, inspect, repair or replace steering systems components, including linkages, gearbox, rack, power steering components and electronically controlled systems.		2
4.9.4. Align steering components, including tires and tracks.		2
4.9.5. Interpret tire and track wear patterns and consider product construction to evaluate replacement needs.		1
4.9.6. Differentiate bearing noise, vehicle pull and wheel vibration, shimmy and noise to determine vehicle efficiency.		2
4.9.7. Measure wheel, tire, axle and hub runout to evaluate replacement needs.		1
4.9.8. Remove, inspect, repair and reinstall the tire, wheel and track assembly, including proper torque procedures.		2
4.9.9. Inspect and replace clamps, rings, slide rings, wheel nuts and wheel studs.		1
Outcome 4.9. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	2
	Level 4:	0
Outcome 4.10. Drive Axle Universal and Differential: Identify, inspect and replace drive axle and differential components.		2
4.10.1. Identify and inspect drive axle and differential assemblies for noise, vibration and fluid leakage concerns.		2
4.10.2. Service and replace the shaft, yokes, boots and joints.		2
4.10.3. Replace drive axle seals, bearings and retainers.		2
4.10.4. Inspect, adjust and replace drive belts and chains.		2
4.10.5. Inspect and replace drive axle housing cover plates, gaskets, sealants, vents, plugs and seals.		1
Outcome 4.10. DOK Frequency	**Level 1:**	1
	Level 2:	4
	Level 3:	0

	Level 4:	0
Outcome 4.11. Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.		2
4.11.1. Interpret symbols and schematic drawings related to hydraulic system design.		1
4.11.2. Describe the physical and mechanical principles of hydraulics.		1
4.11.3. Explain the features, benefits and applications of the different types of hydraulic and hydrostatic systems.		2
4.11.4. Describe the application and operation of major components, including pumps, motors, valves and accumulators.		1
4.11.5. Test and diagnose operating systems.		2
4.11.6. Test, diagnose and repair or replace fluid conveyance components (e.g., hoses, lines, fittings).		1
4.11.7. Test and diagnose electronic controls for hydraulic systems.		2
4.11.8. Evaluate system cleanliness to determine efficiency.		2
4.11.9. Locate hydraulic fittings and ports.		1
4.11.10. Remove, inspect and replace major components, including master cylinders and seals.		3
4.11.11. Measure flow rate, pressure and temperature.		2
4.11.12. Prevent contamination of a hydraulic system.		1
Outcome 4.11. DOK Frequency	**Level 1:**	6
	Level 2:	5
	Level 3:	1
	Level 4:	0
Outcome 4.12. Brakes: Identify, inspect and replace components of braking systems.		2
4.12.1. Identify and locate components of braking systems.		1
4.12.2. Identify pressure concerns in the brake system using hydraulic principles (Pascal's Law).		2
4.12.3. Identify poor stopping, pulling, noise, vibration, premature wear or dragging.		2
4.12.4. Remove, bench bleed and reinstall a master cylinder.		3
4.12.5. Fabricate and install rigid and flexible fluid lines and fittings.		3
4.12.6. Remove the caliper assembly; clean; inspect for leaks, pad condition and damage; and replace.		2
4.12.7. Remove and inspect wheel cylinders.		2
4.12.8. Remove, inspect and replace brake components and inspect for leaks.		2
4.12.9. Inspect the condition and operation of the parking brake and service or replace as needed.		2
Outcome 4.12. DOK Frequency	**Level 1:**	1
	Level 2:	6
	Level 3:	2
	Level 4:	0
Outcome 4.13. Heating and Air Conditioning Systems: Diagnose and repair vehicle heating and air conditioning systems.		2
4.13.1. Apply the physical and mechanical principles of heating and cooling to heating, ventilating and air conditioning (HVAC) systems.		2
4.13.2. Interpret symbols and diagrams to ensure proper repair and replacement.		1
4.13.3. Identify the major components of the HVAC system, their functions and the overall operation of the system.		1
4.13.4. Diagnose heating and air conditioning systems by performing pressure and leak testing.		3
4.13.5. Identify, recover and store recycled refrigerant.		2
4.13.6. Evacuate and charge the air conditioning (A/C) system.		2
Outcome 4.13. DOK Frequency	**Level 1:**	2
	Level 2:	3
	Level 3:	1

	Level 4:	0
Strand 4. DOK Frequency	**Level 1:**	31
	Level 2:	77
	Level 3:	22
	Level 4:	0
Strand 5: Structural Engineering		
Outcome 5.1. Electrical Theory: Interpret and apply electrical and electronic principles and theories.		2
5.1.1. Interpret symbols and wiring diagrams.		1
5.1.2. Describe the features, benefits and applications of electrical and electronic systems.		1
5.1.3. Explain atomic structure and its relationship to electricity.		2
5.1.4. Describe the relationship between electrical effect and electromagnetic effect.		1
5.1.5. Explain methods of producing electrical current.		2
5.1.6. Describe the differences between alternating current (AC) and direct current (DC).		1
5.1.7. Compare and contrast conductors and insulators.		2
5.1.8. Differentiate the relationships among voltage, current, resistance and power in circuits.		1
5.1.9. Measure the amperage of AC and DC electrical systems and system components.		2
5.1.10. Calculate voltage, current, resistance, impedance and power in circuits using Ohm's Law, Kirchhoff's Law and Watt's Law.		2
5.1.11. Describe the purpose of grounding and common methods used for grounding.		1
5.1.12. Describe the uses of series, parallel and series-parallel circuits.		1
5.1.13. Use a digital multimeter to determine voltage, current, frequency and phase.		2
Outcome 5.1. DOK Frequency	**Level 1:**	7
	Level 2:	6
	Level 3:	0
	Level 4:	0
Outcome 5.2. Structural Electrical Circuits: Describe features of an electrical schematic that illustrates a wiring system and interpret and install the design.		2
5.2.1. Describe over-current protective devices and their functions.		1
5.2.2. Identify the types of motors and uses for each.		1
5.2.3. Map circuits and label the service panel directory to reflect devices installed on each circuit.		2
5.2.4. Calculate service requirements for an electrical installation and evaluate for safe capacity.		2
5.2.5. Identify types of cable, conduit, boxes, switches, outlets and other common wiring devices.		1
5.2.6. Identify fasteners, anchors and fire stop systems.		1
5.2.7. Select materials and lay out rough-in wiring runs according to specifications, drawings and code requirements.		3
5.2.8. Select and install lighting technologies (e.g., Halogen, light-emitting diode [LED], incandescent, fluorescent, high-intensity discharge [HID]).		2
5.2.9. Install and service low-voltage lighting and control systems.		2
5.2.10. Install lighting fixtures, wiring devices and covers.		2
5.2.11. Make conductor terminations and connect appliances to circuits.		2
Outcome 5.2. DOK Frequency	**Level 1:**	4
	Level 2:	6
	Level 3:	1
	Level 4:	0
Outcome 5.3. Design and Estimate: Plan and design a basic site plan for a desired outcome.		2
5.3.1. Identify, interpret and use symbols, lines, dimensions, views, sections, site plans, floor plans, specifications, common scales, detail drawings and abbreviations on drawings and prints.		2

5.3.2. Apply proportional reasoning and indirect measurement techniques.		2
5.3.3. Complete a site inventory and analysis, including physical conditions, code and utilities requirements and the environmental impact.		2
5.3.4. Develop a program list, including intended use, budget, economics, customer wants and needs and maintenance.		3
5.3.5. Apply the principles of balance, proportion, scale, focal point, emphasis, rhythm, harmony and unity to create a design.		2
5.3.6. Apply the elements of line, function, form, texture and color to create a design.		2
5.3.7. Incorporate design, organizational and spatial principles into a design.		3
5.3.8. Calculate the space requirements and compute various attributes, including length, angle measurement, surface area and volume.		3
5.3.9. Prepare sketches, drawings, prints, specifications and construction details.		2
5.3.10. Apply designing and drawing tools and industry-specific software to a project, including computer aided design (CAD) software.		3
5.3.11. Identify construction documents, common scales, specifications and materials used in construction or fabrication.		1
5.3.12. Estimate material, construction and equipment needs, availability and costs.		3
5.3.13. Establish the sequential steps of construction and installation.		2
Outcome 5.3. DOK Frequency	**Level 1:**	1
	Level 2:	7
	Level 3:	5
	Level 4:	0
Outcome 5.4. Surveying and Mapping: Perform surveying procedures to construct a site plan.		2
5.4.1. Identify civil drafting symbols and abbreviations.		1
5.4.2. Interpret maps, topographic site plans, deeds and aerial or satellite imagery for site planning.		2
5.4.3. Perform site measurements.		2
5.4.4. Integrate map and surveying data into geographic information system (GIS) or computer aided design (CAD) software.		3
5.4.5. Identify topographical and existing features of areas, including property lines, benchmarks, utilities, streets and setbacks, on survey maps, parcel maps and plats.		1
Outcome 5.4. DOK Frequency	**Level 1:**	2
	Level 2:	2
	Level 3:	1
	Level 4:	0
Outcome 5.5. Geographic Information Systems (GIS): Employ GIS computer applications to interpret data, maps and land use.		2
5.5.1. Interpret and evaluate the accuracy of digital imagery and aerial photography.		2
5.5.2. Explain map projections and the use of scales.		2
5.5.3. Describe GIS data structures (e.g., vector, grid, triangulated irregular network [TIN]).		2
5.5.4. Explain digital elevation methods (e.g., digital elevation model [DEM], global positioning system [GPS]).		2
5.5.5. Interpret spatial interpolation and two- and three-dimensional functional spatial analyses.		3
5.5.6. Demonstrate ranging methods.		2
5.5.7. Identify sources of errors in GIS and formulate corrections and solutions.		3
5.5.8. Determine one's position on the earth using GPS.		2
5.5.9. Integrate GPS data into GIS applications.		3
	Level 1:	0

Outcome 5.5. DOK Frequency	**Level 2:**	6
	Level 3:	3
	Level 4:	0
Outcome 5.6. Construction: Follow architectural plans to construct and repair simple outdoor structures and minor building additions.		2
5.6.1. Compare and contrast the structural properties, grades and types of construction materials.		2
5.6.2. Lay out, cut, smooth, shape and bore construction materials.		2
5.6.3. Lay out, cut and install decks and floors.		2
5.6.5. Lay out, cut and install stairs and steps.		2
5.6.6. Lay out, cut and install roof framing and roof trim accessories.		2
5.6.7. Lay out and install roofing materials.		2
5.6.8. Install exterior doors and window units with hardware.		2
5.6.9. Install exterior sheathing and siding with trim accessories (e.g., gutters and downspouts, posts and railings).		2
5.6.10. Install glass, rigid plastic panels or film plastic.		2
5.6.11. Insulate with draft stops, weather stripping, thermal insulation and vapor barriers.		2
5.6.12. Analyze a surface's condition and select and apply abrasives and fillers.		3
5.6.13. Contrast surface coatings and apply under appropriate environmental conditions.		2
5.6.14. Contrast options and install fencing.		2
Outcome 5.6. DOK Frequency	**Level 1:**	0
	Level 2:	12
	Level 3:	1
	Level 4:	0
Outcome 5.7. Brick, Block and Concrete: Follow a design layout to install a structure using bricks, pavers, blocks, stone or concrete.		2
5.7.1. Describe the physical properties of bricks, pavers, mortar, blocks and concrete.		1
5.7.2. Explain the chemical reactions within and between materials.		2
5.7.3. Describe air ratio and slump.		1
5.7.4. Perform layout and elevations using measurements to scale.		2
5.7.5. Estimate the construction and materials cost for bricks, pavers, mortar, blocks, stone and concrete.		3
5.7.6. Mix, place and finish concrete and mortar.		2
5.7.7. Install cut masonry with and without mortar or adhesives.		2
5.7.8. Install footers, lintels, sills, poured walls, floors and accessories.		2
5.7.9. Install gravel and sand pads.		2
5.7.10. Identify the composition of concrete and describe the chemical reaction of curing.		1
5.7.11. Layout and construct forms and reinforce them using steel, wire and other materials.		2
5.7.12. Layout and install anchor bolts in concrete.		2
5.7.13. Cure and install joints in concrete.		2
5.7.14. Select curing, coloring and texturing additives or specialty finishes and apply to concrete for a specific purpose.		2
Outcome 5.7. DOK Frequency	**Level 1:**	3
	Level 2:	10
	Level 3:	1
	Level 4:	0
Outcome 5.8. Water Distribution Systems: Calculate the demand for specific water applications and design and install water supply and drainage components.		2
5.8.1. Calculate water demand for specific applications.		2

5.8.2. Compare the types, applications and operating principles of pumps and controls.		2
5.8.3. Locate water system entry points, walls and chases.		1
5.8.4. Identify components of supply and drainage systems and describe their functions.		2
5.8.5. Describe how waste moves from a fixture through the drain system to the environment.		1
5.8.6. Describe factors that are considered when planning and installing a supply and drainage system.		1
5.8.7. Estimate and compute length, angle of measurement, area, surface area and volume to calculate pipe legs and pipe sizes.		2
5.8.8. Calculate the slope required for drainage components.		2
5.8.9. Select supply and drainage components based on their application for a given purpose.		3
5.8.10. Explain the impact of modifying structural members to accommodate supply and drainage lines.		3
5.8.11. Join pipe, pipefittings and valves of similar and dissimilar materials using solder, brazing, solvents and mechanical means of joining.		2
5.8.12. Connect plumbing fixtures and appliances to a supply and drainage system.		2
5.8.13. Compare and contrast sources of contamination in water supplies and methods of filtering and disinfecting water.		2
5.8.14. Prevent freezing and mechanical damage to pipes.		2
5.8.15. Describe how water moves from the source through the water distribution system to the fixture.		2
5.8.16. Test a water supply and drainage system for leaks and pressure using soap, inert gas, electronic sensors and fluorescent dye.		3
5.8.17. Maintain plumbing fixtures.		2
Outcome 5.8. DOK Frequency	**Level 1:**	3
	Level 2:	11
	Level 3:	3
	Level 4:	0
Outcome 5.9. Physics and Metallurgy of Welding: Apply the physics and metallurgy of welding in joining materials.		2
5.9.1. Assess how the welding arc produces a weld.		1
5.9.2. Identify the factors that affect heat transfer and melting.		1
5.9.3. Describe the effects of arc length and shielding gases on the arc.		1
5.9.4. Identify key variables that determine the type of metal transfers.		1
5.9.5. Analyze the relationship between wire feed speed and welding current.		2
5.9.6. Describe pulsed arc transfer mode.		1
5.9.7. Apply the effects of wire size to deposition rate and current ranges.		2
5.9.8. Compare constant current and constant voltage power sources and how they relate to the self-regulation of arcs.		2
5.9.9. Explain conditions when arc blow occurs and how to reduce arc blow.		1
5.9.10. Analyze phases of matter and phase changes during solidification.		2
5.9.11. Apply concepts of how the common crystal structure in metallic materials affects welds.		3
5.9.12. Explain point, line and surface imperfection in a metal crystal structure.		3
5.9.13. Critique the types of weld imperfections and indicate their effects on material properties.		3
Outcome 5.9. DOK Frequency	**Level 1:**	6
	Level 2:	4
	Level 3:	3
	Level 4:	0
Outcome 5.10. Joining and Cutting Metals with Heat: Join and cut steel using heat in horizontal and vertical positions.		2
5.10.1. Classify, select, handle and store electrodes and match them to the job requirements based on the		2

desired level of penetration and heat range.		
5.10.2. Determine the correct welder type, wire diameter and gas to be used in a specific welding situation.		1
5.10.3. Compare and contrast metal welding operating characteristics and performance (e.g., oxy-fuel, shielded metal arc, gas tungsten arc, braising, soldering).		2
5.10.4. Select the joint design, weld type and welding position.		1
5.10.5. Set up and adjust the welder according to the material being welded and influencing conditions.		2
5.10.6. Store, handle and install high pressure gas cylinders.		2
5.10.7. Clean, prepare, align and secure the metal to be welded.		2
5.10.8. Compensate for the effects of expansion and contraction forces when joining metals.		3
5.10.9. Employ protective methods for surrounding equipment and materials during welding and cutting operations.		2
5.10.10. Perform continuous, stitch, tack, plug, butt and pinch welds with and without backing and fillet welds.		2
5.10.11. Conduct tests on each weld type and causes of defects.		3
5.10.12. Cut steel using oxy fuel and plasma equipment.		2
Outcome 5.10. DOK Frequency	**Level 1:**	2
	Level 2:	8
	Level 3:	2
	Level 4:	0
Outcome 5.11. Fabricating with Cold Metals: Repair metal structures and equipment through cutting, shaping, forming and joining metal stock.		2
5.11.1. Evaluate metal structures and equipment and plan the method of repair.		3
5.11.2. Lay out and cut metal.		2
5.11.3. Shape stock through bending, cutting, drilling and filing.		2
5.11.4. Form and assemble metal through cutting and bending.		2
5.11.5. Edge metal through wiring, turning, beading and crimping.		2
5.11.6. Identify various methods of fastening sheet metal.		1
5.11.7. Fasten metal using a range of hardware.		2
5.11.8. Process cold metals through tapping, threading, torqueing and smoothing.		2
5.11.9. Analyze the surface condition and select and apply abrasives and fillers for metals.		3
5.11.10. Contrast surface coatings and apply them under appropriate environmental conditions.		2
Outcome 5.11. DOK Frequency	**Level 1:**	1
	Level 2:	7
	Level 3:	2
	Level 4:	0
Strand 5. DOK Frequency	**Level 1:**	29
	Level 2:	90
	Level 3:	22
	Level 4:	0
Strand 6: Environmental Science		
Outcome 6.1. Soils: Apply knowledge of soil characteristics and soil information resources to overcome any existing soil use limitations while maintaining or improving soil quality.		2
6.1.1. Identify soil forming factors and explain how they produce variability in soils.		1
6.1.2. Describe the relationship among physical properties of soils.		1
6.1.3. Collect, test and analyze soil samples for physical and chemical properties.		2
6.1.4. Identify factors (e.g., climate, vegetation, soil texture, drainage, management practices, landscape) affecting organic matter and its function in soil quality.		1

6.1.5. Determine land use and identify land capabilities classes.		2
6.1.6. Apply soil conservation practices to reduce soil erosion and compaction.		3
6.1.7. Compare and contrast the causes and effects of soil erosion.		2
6.1.8. Describe soil limitations in agronomic, urban and natural resource practices.		2
6.1.9. Evaluate soil survey data and implement management decisions.		3
6.1.10. Assess basic processes of soil reclamation.		2
Outcome 6.1. DOK Frequency	**Level 1:**	3
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 6.2. Water Quality: Analyze, interpret and manage the biological, chemical and physical properties of water quality.		2
6.2.1. Assess and explain the interactions between human activities and the Earth's hydrosphere (e.g., septic systems, desalinization, point and non-point source pollution).		2
6.2.2. Measure pH, dissolved oxygen (DO), biological oxygen demand (BOD), temperature and macroinvertebrate populations to determine water quality.		2
6.2.3. Measure hardness, nitrogen, phosphorus, vegetation and physical characteristics of lentic and lotic waters to determine water quality.		2
6.2.4. Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human and animal activity impacts the cycle.		2
6.2.5. Explain the biotic and abiotic factors affecting water quality.		2
6.2.6. Monitor and analyze water quality and quantity.		3
6.2.7. Implement procedures and management practices that maintain or improve water quality.		4
Outcome 6.2. DOK Frequency	**Level 1:**	0
	Level 2:	5
	Level 3:	1
	Level 4:	1
Outcome 6.3. Air Quality: Analyze, interpret and manage the biological, chemical and physical properties of air quality.		2
6.3.1. Determine the chemical and physical properties of air (e.g., composition, density, pressure).		2
6.3.2. Explain biogeochemical cycles (e.g., nitrogen, oxygen, sulfur) and how they relate to the biosphere, geosphere and atmosphere.		1
6.3.3. Explain the effects of carbon dioxide sequestration on air quality.		1
6.3.4. Analyze the importance of air quality to humans and other living organisms.		2
6.3.5. Explain human and natural factors (e.g., volcanic eruptions, forest fires, greenhouse gases, farming practices, transportation) affecting air quality.		1
6.3.6. Monitor and evaluate air composition, quality and quantity with direct reading instruments (e.g., combustible gas indicator, oxygen meter).		3
6.3.7. Assess the potential for air contamination at a specific site.		3
6.3.8. Implement procedures and management practices that maintain or improve air quality.		4
Outcome 6.3. DOK Frequency	**Level 1:**	3
	Level 2:	2
	Level 3:	2
	Level 4:	1
Outcome 6.4. Water Use and Management: Collect, analyze and interpret data for a localized water use and management plan.		2
6.4.1. Explain the domains of hydrology.		1

6.4.2. Describe the geological and meteorological principles affecting water supplies.		1
6.4.3. Conduct a pumping test to determine groundwater potential and discharge rates.		2
6.4.4. Identify the criteria for water well designs.		1
6.4.5. Measure surface water volume and discharge rates.		2
6.4.6. Conduct channel flow analyses.		2
6.4.7. Evaluate water collection, storage and distribution systems (e.g., wells, ponds, runoff, waterways, irrigation).		3
6.4.8. Define, delineate and assess the volume of watersheds and streams.		3
6.4.9. Assess the potential for surface water and groundwater contamination at a specific site.		2
6.4.10. Implement management practices that conserve and sustain water.		4
Outcome 6.4. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	2
	Level 4:	1
Outcome 6.5. Potable Water Treatment: Monitor the water treatment processes for potable water at a specific site.		2
6.5.1. Identify and assess the characteristics of potable water treatment and the sources of water.		1
6.5.2. Collect and analyze water samples to determine potability.		2
6.5.3. Describe components of a water treatment facility.		1
6.5.4. Monitor the water treatment process (e.g., aeration, flocculation, filtration, sedimentation).		3
6.5.5. Monitor the control and treatment of chemical and biological contaminants (e.g., trihalomethanes, lead, bacteria, nitrates) in water.		3
6.5.6. Describe taste and odor control in water treatment.		1
6.5.7. Identify methods for backflow prevention.		1
Outcome 6.5. DOK Frequency	**Level 1:**	4
	Level 2:	1
	Level 3:	2
	Level 4:	0
Outcome 6.6. Wastewater Operations: Monitor the wastewater collection and treatment methods for a specific site.		2
6.6.1. Identify the components of a wastewater treatment system.		1
6.6.2. Collect and analyze wastewater samples.		2
6.6.3. Identify, analyze and reconcile the components of wastewater.		3
6.6.4. Troubleshoot wastewater collection and treatment systems.		2
6.6.5. Describe the processes in wastewater treatment (e.g., mixing, coagulation, flocculation, disinfection, treatment system, effluent disposal, solids management).		2
6.6.6. Analyze process optimization and treatment processes for the treatment train, effluent disposal and bio-solids management in wastewater treatment.		3
6.6.7. Compare methods for cross-connection and backflow prevention.		2
Outcome 6.6. DOK Frequency	**Level 1:**	1
	Level 2:	4
	Level 3:	2
	Level 4:	0
Outcome 6.7. Solid Waste and Renewable Resource Management: Control and process solid waste using current and alternative technologies.		3
6.7.1. Collect, analyze and treat solid waste materials (e.g., mortalities, manure, garbage).		3
6.7.2. Distinguish the risks associated with solid waste accumulation, utilization and disposal.		1

6.7.3. Determine an acceptable site for solid waste disposal.		2
6.7.4. Compare the processes of aerobic and anaerobic waste decomposition.		1
6.7.5. Describe and monitor solid waste disposal procedures (e.g., landfill, compost).		3
6.7.6. Describe and implement solid waste management methods (e.g., composting, incineration, recycling, burial).		3
6.7.7. Explain the control processes and potential uses for solid waste byproducts (e.g., leachate, ash, landfill gas, sludge, methane, manure).		2
6.7.8. Describe standard operating procedures and identify design requirements for specific purposes (e.g., landfill, lagoon, leachate treatment).		3
6.7.9. Evaluate site closure methods and post-closure monitoring.		3
6.7.10. Determine type and volume of solid waste generated by an operation or facility.		2
Outcome 6.7. DOK Frequency	**Level 1:**	2
	Level 2:	3
	Level 3:	5
	Level 4:	0
Outcome 6.8. Contaminants and Pollution Control: Assess an affected area, determine the source and type of contaminant and respond.		3
6.8.1. Collect, record and analyze environmental samples and interpret the results.		3
6.8.2. Determine the types, sources and impact of natural and man-made contaminants.		2
6.8.3. Monitor, analyze and quantify levels of contaminants from point and non-point sources.		3
6.8.4. Monitor radioactive contamination.		2
6.8.5. Monitor noise and light pollution and recommend abatement measures.		3
6.8.6. Describe the environmental impact from both industrial and nonindustrial processes.		1
6.8.7. Identify, comply with and implement contaminant control, remediation and prevention practices (e.g., biological, sanitation, buffer strips).		4
6.8.8. Recommend a remediation strategy for a release of contaminant to soil, surface water or groundwater.		3
6.8.9. Monitor and conduct remediation activities.		3
6.8.10. Develop and implement various emergency response plans.		2
6.8.11. Identify and contact local emergency response teams.		2
6.8.12. Analyze environmental conditions that influence environmental response.		3
Outcome 6.8. DOK Frequency	**Level 1:**	1
	Level 2:	4
	Level 3:	6
	Level 4:	1
Outcome 6.9. Hazardous Materials and Waste Management: Follow and apply handling, storage and recording procedures for hazardous materials and waste.		2
6.9.1. Identify and differentiate solid waste, hazardous waste, toxic waste and radioactive waste streams.		1
6.9.2. Describe health and safety practices for reducing risks from hazardous materials (e.g., safety data sheet [SDS], employer notification forms, personal protective equipment [PPE]).		1
6.9.3. Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical releases, fires, explosions).		2
6.9.4. Obtain and use information addressing hazardous substance discharge.		2
6.9.5. Demonstrate safe management, handling, disposal and recycling procedures for hazardous materials and waste.		2
6.9.6. Perform site assessments to detect and identify the presence and storage of hazardous materials.		3
6.9.7. Collect and evaluate samples of hazardous materials and waste.		3

6.9.8. Prepare hazardous materials for transportation and storage in accordance with regulations.		2
6.9.9. Prepare and maintain hazardous material handling documentation.		2
6.9.10. Identify hazardous materials that can be recycled.		1
Outcome 6.9. DOK Frequency	**Level 1:**	3
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 6.10. Ecosystems: Evaluate biotic and abiotic components and relationships in ecosystems to apply restoration and conservation practices that maintain functionality.		2
6.10.1. Describe ecological levels, including population, community, ecosystem and biosphere.		1
6.10.2. Distinguish the flow of energy through ecosystems.		2
6.10.3. Identify and classify interactions among organisms, including predation, symbiosis and competition, to determine species interdependent relationships.		2
6.10.4. Describe the process of succession and its impact on ecosystems.		1
6.10.5. Connect biotic interactions with the abiotic environment.		3
6.10.6. Describe biogeochemical cycles (e.g., carbon, nitrogen, phosphorous, hydrological) and their roles in maintaining equilibrium in an ecosystem.		3
6.10.7. Identify interactions of ecosystems to differentiate biomes.		2
6.10.8. Select and implement restoration ecology practices to repair damaged ecosystems.		3
6.10.9. Determine the impact of native and non-native invasive species on ecosystems.		2
6.10.10. Describe the relationship between evolution and ecosystems.		1
Outcome 6.10. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	3
	Level 4:	0
Outcome 6.11. Habitat Management and Restoration: Develop a plan for the management and restoration of a specific habitat.		
6.11.1. Differentiate the properties and characteristics of habitats.		1
6.11.2. Examine sites and place them into ecological classifications.		2
6.11.3. Explain the impacts of an increasing human population on habitats.		2
6.11.4. Evaluate the current and historical interactions between human activities and habitats.		3
6.11.5. Differentiate threatened, endangered, extirpated and extinct species.		2
6.11.6. Survey and monitor species within a habitat.		2
6.11.7. Explain the role of various stakeholders, including individuals, non-governmental organizations (NGOs), corporations and governments in habitat restoration and conservation.		1
6.11.8. Implement techniques used in habitat management, mitigation, enhancement and restoration.		3
6.11.9. Implement practices to enhance biological diversity.		3
6.11.10. Develop a management plan for the sustainability of a specific habitat using environmental practices.		4
Outcome 6.11. DOK Frequency	**Level 1:**	2
	Level 2:	4
	Level 3:	3
	Level 4:	1
Strand 6. DOK Frequency	**Level 1:**	25
	Level 2:	49
	Level 3:	32
	Level 4:	5

Strand 7: Food Science		
Outcome 7.1. The Science of Food: Differentiate the structures, functions and sources of basic functional ingredients and the roles they play in the development and manufacturing of food products for human nutrition.		2
7.1.1. Classify the matter in foods by elements, compounds, mixtures, chemical bonds, organic and inorganic properties and physical and chemical changes.		2
7.1.2. Distinguish 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 food processing.		2
7.1.3. Measure the acidity, alkalinity and molarity of food products and describe the role of pH in food processing and storage.		2
7.1.4. Assess water's function in food processing, distinguish between moisture content and water activity and differentiate how water activity affects food functionality and storage.		2
7.1.5. Describe the composition, structure and sources of sugars, complex carbohydrates, lipids, vitamins, minerals and proteins (i.e., functional ingredients) and their nutritional contributions to dietary needs.		3
7.1.6. Relate the functions and physical properties of simple and complex carbohydrates, lipids, vitamins, minerals and proteins (i.e., functional ingredients) to the manufacturing of food products.		3
7.1.7. Describe the roles of enzymes as catalysts and the factors that affect enzyme activity.		1
7.1.8. Differentiate the metabolic processes and the factors that affect metabolic changes in the human body, including anabolism, catabolism and basal metabolism.		2
7.1.9. Describe the structure of molds, bacteria, viruses, prions and yeast; how they reproduce; the factors that affect their growth and their roles in food production.		2
7.1.10. Identify the functions of food additives in food products.		1
Outcome 7.1. DOK Frequency	**Level 1:**	2
	Level 2:	6
	Level 3:	2
	Level 4:	0
Outcome 7.2. Quality Assurance: Inspect the food production process, locate potential sources of food quality and safety deviations in facilities and prepare a corrective action plan.		2
7.2.1. Describe the types of spoilage (e.g., oxidation, microbial), their sources and impact.		1
7.2.2. Describe the internal and external quality attributes that a food product should possess.		1
7.2.3. Test food quality through chemical, microbiological, sensory and physical methods.		2
7.2.4. Evaluate, inspect and select raw food products for manufacturing, based on raw ingredient specifications.		3
7.2.5. Develop a quality check, based on finished food product attributes, specifications and regulations.		3
7.2.6. Describe types of quality systems (e.g., Global Food Safety Initiative [GFSI], International Organization for Standardization [ISO], Safe Quality Food [SQF], British Retail Consortium [BRC]).		2
Outcome 7.2. DOK Frequency	**Level 1:**	2
	Level 2:	2
	Level 3:	2
	Level 4:	0
Outcome 7.3. Meat Science: Perform safe and sanitary harvest techniques and determine meat quality.		2
7.3.1. Describe the benefits of an antemortem inspection, in relation to food safety.		1
7.3.2. Perform humane harvesting techniques, including stunning, shackling and bleeding.		2
7.3.3. Remove and inspect offal postmortem for signs of disease or contamination.		3
7.3.4. Prepare a carcass for chilling and inspection through species-specific techniques (e.g., splitting, washing, weighing).		2
7.3.5. Describe the role of post mortem metabolism in converting muscle to meat.		1
7.3.6. Differentiate the degrees of marbling and describe its role in the quality grading of meat.		2

7.3.7. Calculate the maturity of an animal using skeletal ossification and lean maturity ratings.		2
7.3.8. Issue yield grades using the amount of boneless, closely trimmed retail cuts from the high-value parts of the carcass.		3
7.3.9. Calculate carcass value using a grid-based marketing system.		3
7.3.10. Fabricate carcasses into species-specific wholesale and retail cuts.		2
Outcome 7.3. DOK Frequency	**Level 1:**	2
	Level 2:	5
	Level 3:	3
	Level 4:	0
Outcome 7.4. Food Production and Processing: Process a food product for distribution and consumption.		2
7.4.1. Describe the process used in thermal and non-thermal preservation, control the variables and apply processing methods (e.g., retorting, high pressure, ultra-high temperature [UHT], high temperature short time [HTST], chilling, freezing).		2
7.4.2. Describe the process of dehydration and concentration, control the variables that affect the quality of dried foods and apply the methods.		3
7.4.3. Describe the functions and types of packaging operations, equipment and materials and use them to manufacture food products (e.g., metal, glass, paper, plastic, film, laminates, edible coatings).		2
7.4.4. Compare and contrast reduced oxygen packaging (ROP) processes (e.g., controlled and modified atmosphere packaging, desiccants) and use them to manufacture food products.		3
7.4.5. Process food through mixing, grinding, pumping and washing and describe the physical change in the food product.		2
7.4.6. Identify the characteristics and properties of mixtures (e.g., solutions, colloidal dispersions and suspensions) and select and apply appropriate chemical or biological separation techniques.		1
7.4.7. Process raw materials and products and apply food grading systems and standards of identity.		2
7.4.8. Compare and contrast storage and distribution methods for shelf-stable and non-shelf-stable products.		2
7.4.9. Determine the environmental impact of processing a food product.		1
7.4.10. Differentiate among beneficial microorganisms (e.g., bacteria, mold, yeast) and their uses in food production.		2
7.4.11. Process food products through biological processing (e.g., fermenting, enzymes, microbes).		2
7.4.12. Manage processes for handling the solid and liquid waste from manufacturing food products.		3
Outcome 7.4. DOK Frequency	**Level 1:**	2
	Level 2:	7
	Level 3:	3
	Level 4:	0
Outcome 7.5. Food Product Development: Apply principles of nutrition and human behavior to create a new food prototype that meets a specific dietary need or demand for consumption, design packaging and seek label approval.		2
7.5.1. Conduct a sensory evaluation of food products.		2
7.5.2. Identify consumer preferences, trends and opportunities affecting food product development.		1
7.5.3. Manipulate ingredients to meet a desired product goal.		3
7.5.4. Calculate nutrient values, serving sizes and nutrient variability for a food product.		2
7.5.5. Calculate the amounts of restricted ingredients in food products.		2
7.5.6. Develop a food product package and label according to industry standards.		3
7.5.7. Estimate the shelf life and potential changes in attributes over time.		2
7.5.8. Create new uses for low value components of the food generation process.		4
7.5.9. Create a new product roll out plan (e.g., concept, bench trial, market assessment, industrial trial, consumer acceptance).		3
7.5.10. Describe regulatory and patent requirements.		2

Outcome 7.5. DOK Frequency	**Level 1:**	1
	Level 2:	5
	Level 3:	3
	Level 4:	1
Outcome 7.6. Food Safety and Sanitation: Develop a food safety and sanitation plan, addressing processing facility needs and contamination points.		3
7.6.1. Identify, isolate and monitor food product allergens.		3
7.6.2. Establish and implement procedures for preoperational inspection and cleaning.		2
7.6.3. Identify the sources and types of food-borne illness and pathogens and prevent their entrance into the food supply.		1
7.6.4. Develop and implement a pest control system.		3
7.6.5. Conduct a good manufacturing practice (GMP) audit, review the findings and implement corrective actions.		2
7.6.6. Identify and monitor hazards and critical control points and apply hazard analysis and critical control point (HACCP) corrective action procedures.		3
7.6.7. Determine critical safety parameters using government regulations for handling and storage.		3
7.6.8. Identify the key activities (e.g., recall exercise, regulatory notification) of a recall program.		2
7.6.9. Identify the government agencies involved in the production and regulation of food products.		1
Outcome 7.6. DOK Frequency	**Level 1:**	2
	Level 2:	3
	Level 3:	4
	Level 4:	0
Outcome 7.7. Biosecurity: Connect the sources and causes of contamination and develop the protocols to implement bio-security procedures.		3
7.7.1. Investigate sources and origins of agents that can contaminate processed and unprocessed food products.		2
7.7.2. Identify activities and biological agents that contribute to the risk of acquiring or preventing a specific disease.		1
7.7.3. Identify sources of biological and chemical tampering points.		1
7.7.4. Assess a facility's biosecurity, classify the level of risk and recommend improvements.		3
7.7.5. Implement biosecurity procedures to prevent cross-site contamination (e.g., proper use and disposal of personal protective equipment [PPE] from site to site, vehicle cleaning between farm and processing site).		2
7.7.6. Screen and test animals and plant products for infectious agents or contamination.		3
7.7.7. Select bio-containment practices (e.g., quarantine, eradicate, showering into facilities) to manage pests and diseases.		3
7.7.8. Manage the biosecurity of raw materials and finished products during transportation (e.g., security seals, chain of custody).		4
Outcome 7.7. DOK Frequency	**Level 1:**	2
	Level 2:	2
	Level 3:	3
	Level 4:	1
Strand 7. DOK Frequency	**Level 1:**	13
	Level 2:	35
	Level 3:	22
	Level 4:	2
Strand 8: Plant Science		
Outcome 8.1. Plant Nutrition: Select and apply macronutrients and micronutrients based on deficiencies,		

identified using testing application methods and optimum management, that account for environmental factors.		2
8.1.1. Compare and contrast organic and inorganic sources of macronutrients and micronutrients.		2
8.1.2. Describe the functions of macronutrients and micronutrients in plants and the role that microorganisms play in plant nutrition.		1
8.1.3. Determine the nutrient requirements of plants.		2
8.1.4. Identify symptoms and causes of plant nutrient deficiencies and toxicities.		1
8.1.5. Collect soil and plant tissue for testing and analysis.		2
8.1.6. Analyze and draw conclusions from soil and plant tissue test data.		3
8.1.7. Distinguish between biotic and abiotic factors (e.g., minerals, pH, microorganisms) that influence and optimize the availability of nutrients for plants.		2
8.1.8. Calculate nutrient requirements and select nutrient sources and additives for optimum economic return.		2
8.1.9. Determine the nutrient content of organic and inorganic fertilizers.		1
8.1.10. Select the methods and time of nutrient application and apply nutrients.		3
Outcome 8.1. DOK Frequency	**Level 1:**	3
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 8.2. Plant Reproduction: Propagate and cultivate plants for specific characteristics and economic variables for both greenhouses and crops.		2
8.2.1. Identify the reproductive anatomy of plants and describe their physiological functions.		1
8.2.2. Describe how biotic and abiotic factors (e.g., insects, light, temperature, microorganisms, moisture, location) influence and optimize plant reproduction.		1
8.2.3. Compare and contrast variations of plant reproductive systems among plant species.		2
8.2.4. Select seeds and seed stock for desired traits.		2
8.2.5. Select and apply methods that create desired traits in seeds.		3
8.2.6. Select and apply all methods of asexual plant propagation for desired traits (e.g., grafting, layering, cutting, cloning).		3
Outcome 8.2. DOK Frequency	**Level 1:**	2
	Level 2:	2
	Level 3:	2
	Level 4:	0
Outcome 8.3. Pest Management: Develop and implement an integrated pest management (IPM) plan by scouting and identifying specific plant pests and the damage they cause and apply specialized control methods.		3
8.3.1. Identify and classify insect, weed, disease and animal pests.		1
8.3.2. Examine the interrelationships among plants, pests, humans and the environment.		1
8.3.3. Analyze and calculate the economic threshold of pest damage.		2
8.3.4. Determine and implement pest management safety practices (e.g., safety data sheets [SDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA], personal protective equipment [PPE], worker protection standards [WPS], refuge management strategy).		3
8.3.5. Evaluate the effectiveness of a pest management plan.		3
8.3.6. Describe genetic adaptations and modifications (e.g., Bt corn, glyphosate resistant soybean) that have led to fungal, bacterial and insect resistance in plants.		1
8.3.7. Describe the types and functions of biological and mechanical control methods.		1
8.3.8. Describe the types and functions of chemical pesticide control measures.		1

8.3.9. Develop an IPM plan, based on pest life cycles, available treatments, application methods and the impact on the environment.		3
8.3.10. Select application methods and implement an IPM plan.		3
8.3.11. Evaluate IPM plans and applications for their impact on the environment and their effectiveness.		3
Outcome 8.3. DOK Frequency	**Level 1:**	5
	Level 2:	1
	Level 3:	5
	Level 4:	0
Outcome 8.4. Growth and Management: Manage and manipulate plant development through the selection, planting and growing of seeds and plants, based on global demand, economic importance and growing conditions.		2
8.4.1. Identify and classify plants using taxonomy.		1
8.4.2. Identify plant anatomical structures and tissues.		1
8.4.3. Identify and classify seeds and plants at all stages of growth.		1
8.4.4. Explain requirements necessary for photosynthesis to occur and identify the products and byproducts of photosynthesis.		2
8.4.5. Understand aerobic respiration and its relationship to plant growth and management.		2
8.4.6. Identify the principles of primary and secondary plant growth.		1
8.4.7. Identify the plant responses to plant growth regulators and different forms of tropism.		1
8.4.8. Understand the influence of environmental factors on plant growth, development and maintenance.		2
8.4.9. Manipulate natural and artificial factors to influence plant germination, growth and development.		3
8.4.10. Select, evaluate and prepare soil or media for planting.		2
8.4.11. Understand and evaluate the process by which plants are selected.		3
8.4.12. Evaluate and implement planting practices (e.g., population rate, germination, seed vigor, inoculation, seed and plant treatments, type of planter, cuttings, pot in pot).		3
8.4.13. Evaluate and implement transplanting practices.		3
8.4.14. Control plant growth through mechanical and chemical means.		2
8.4.15. Analyze plant water requirements and provide water through artificial or natural means.		2
8.4.16. Explain the process and importance of transpiration in plant growth and development.		2
8.4.17. Recognize plant disease symptoms, prevention, avoidance and treatments.		1
Outcome 8.4. DOK Frequency	**Level 1:**	6
	Level 2:	7
	Level 3:	4
	Level 4:	0
Outcome 8.5. Harvesting: Evaluate and implement harvesting methods to maximize yield.		3
8.5.1. Identify characteristics of grains, seeds, vegetables, fruits and ornamental plants that indicate crop maturity.		1
8.5.2. Describe safety precautions to take when harvesting.		1
8.5.3. Adjust to environmental conditions to enhance the harvesting of plant products.		2
8.5.4. Evaluate techniques to maximize yield through mechanical or hand harvesting methods.		3
8.5.5. Calculate potential yield and loss due to harvesting.		2
8.5.6. Evaluate the impact of harvest techniques on the quality of plants and plant products.		3
8.5.7. Identify harvesting methods and harvesting equipment.		1
8.5.8. Assess the stage of growth to determine the maturity and salability of grains, seeds, vegetables, fruits and ornamental plants.		2
8.5.9. Operate mechanized harvesting equipment.		3
8.5.10. Implement non-mechanized harvesting techniques.		2

8.5.11. Evaluate crop yield and loss data.		3
8.5.12. Implement management practices to reduce loss.		3
Outcome 8.5. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	5
	Level 4:	0
Outcome 8.6. Handling and Storage: Handle and store plants and plant products to maximize quality.		2
8.6.1. Describe safety precautions in handling and storage practices.		1
8.6.2. Adjust to environmental conditions to enhance the handling and storage of plant products.		3
8.6.3. Apply harvesting, handling and storage techniques to minimize loss and maximize economic return.		2
8.6.4. Calculate potential yield and loss due to processing and storage.		2
8.6.5. Explain the proper conditions to maintain the quality of plants and plant products held in storage.		2
8.6.6. Maintain and enhance the quality of plant products through the manipulation of handling and storage techniques (e.g., temperature, humidity, retardants, light, chemicals, contamination).		3
8.6.7. Prepare products for sale, transportation and storage.		2
8.6.8. Identify storage methods for plants and plant products.		1
8.6.9. Monitor environmental conditions in storage facilities for plants and plant products.		2
8.6.10. Explain the reasons for preparing plants and plant products for distribution.		1
8.6.11. Implement and evaluate techniques for grading, handling, packaging and loading plants and plant products for distribution or transportation.		3
Outcome 8.6. DOK Frequency	**Level 1:**	3
	Level 2:	5
	Level 3:	3
	Level 4:	0
Strand 8. DOK Frequency	**Level 1:**	22
	Level 2:	28
	Level 3:	23
	Level 4:	0
Strand 9: Energy		
Outcome 9.1. Energy Sources: Identify energy sources according to their economic viability, sustainability and environmental impact.		2
9.1.1. Identify, compare and contrast fossil fuel sources and the technology used to generate energy.		2
9.1.2. Identify, compare and contrast renewable energy sources and the technology used to generate energy.		2
9.1.3. Identify, compare and contrast alternative energy sources and technology used to generate energy (e.g., fuel cells, hydrogen, nuclear).		2
9.1.4. Identify the social, economic and environmental drivers and barriers that influence the development and use of energy sources.		1
9.1.5. Calculate fuel equivalents among energy sources.		2
9.1.6. Trace the transformations of energy within a system (e.g., mechanical to electrical, chemical to mechanical).		2
9.1.7. Determine best management practices (e.g., carbon sequestration, conservation, animal safety, efficiency) that lessen environmental impact.		3
9.1.8. Perform an energy evaluation to determine the best social, economic and environmental solution.		3
Outcome 9.1. DOK Frequency	**Level 1:**	1
	Level 2:	5
	Level 3:	2
	Level 4:	0

Outcome 9.2. Crude Oil and Natural Gas: Describe the processes for exploring, drilling, producing, transporting, marketing and refining crude oil and natural gas.		2
9.2.1. Describe the role of geology in the formation, migration and trapping of crude oil and natural gas.		1
9.2.2. Assess how crude oil and natural gas wells are sited, designed and installed.		2
9.2.3. Identify and explain the processes associated with drilling (e.g., rig types, blowout prevention, drilling fluids, casing, cementing).		2
9.2.4. Evaluate different environmental procedures for the storage, containment, transporting, recycling, processing and disposing of drilling liquids (e.g., drilling fluids, brine, flow-back).		3
9.2.5. Identify and apply the appropriate permits and laws associated with the crude oil and natural gas industry.		3
9.2.6. Identify the different processes for producing, treating, compressing, transporting, processing and storing crude oil and natural gas.		2
9.2.7. Operate and maintain compressor, cryogenic and dehydration equipment.		2
9.2.8. Identify the products and byproducts of crude oil and natural gas extraction and refining.		2
Outcome 9.2. DOK Frequency	**Level 1:**	1
	Level 2:	5
	Level 3:	2
	Level 4:	0
Outcome 9.3. Biomass: Describe and manage processes required to extract energy from biomass.		2
9.3.1. Identify applications for biomass energy.		1
9.3.2. Describe the thermal, chemical and biochemical methods of converting biomass into energy.		1
9.3.3. Identify feedstock materials (e.g., plants, algae, municipal waste) used to produce energy and compare the energy potential of each.		2
9.3.4. Identify and differentiate the aerobic and anaerobic digestion of biomass.		2
9.3.5. Test source materials and final products and compare the results to industry standards.		3
9.3.6. Process source materials for energy conversion.		2
9.3.7. Identify and describe technical standards and regulations for residential, agricultural and commercial biofuel operations.		2
9.3.8. Identify the byproducts generated in the production of biofuels and apply methods for their extraction, use and disposal.		1
9.3.9. Manage storage and distribution systems for biofuels.		3
Outcome 9.3. DOK Frequency	**Level 1:**	3
	Level 2:	4
	Level 3:	2
	Level 4:	0
Outcome 9.4. Solar Energy: Plan, install and maintain a solar array that can collect, store and distribute solar energy.		3
9.4.1. Identify the different types of solar energy devices (e.g., photovoltaic [PV], solar thermal, concentrating solar power [CSP]) and how they produce energy.		2
9.4.2. Conduct a site evaluation to identify an appropriate solar panel installation.		3
9.4.3. Select the appropriate solar energy application for commercial and residential solar power.		2
9.4.4. Design a layout of solar arrays and associated equipment.		3
9.4.5. Identify and describe technical standards and regulations for a solar energy installation.		3
9.4.6. Interpret an electric schematic for a solar energy installation.		1
9.4.7. Install, test and maintain a solar energy installation.		3
9.4.8. Compare and contrast equipment disposal methods.		2
	Level 1:	1

Outcome 9.4. DOK Frequency	**Level 2:**	3
	Level 3:	4
	Level 4:	0
Outcome 9.5. Wind Energy: Plan and maintain a wind energy installation that captures, stores and distributes electrical energy.		3
9.5.1. Describe the internal and external components of wind energy installation.		1
9.5.2. Conduct a site evaluation to identify an appropriate wind turbine installation.		3
9.5.3. Identify and describe technical standards and regulations for wind turbines.		2
9.5.4. Describe and differentiate the manufacturing processes for producing wind turbines.		2
9.5.5. Select and design an appropriate wind energy installation for commercial and residential applications.		3
9.5.6. Interpret an electric schematic for a wind energy installation.		2
9.5.7. Test and maintain wind energy components.		3
Outcome 9.5. DOK Frequency	**Level 1:**	1
	Level 2:	3
	Level 3:	3
	Level 4:	0
Strand 9. DOK Frequency	**Level 1:**	7
	Level 2:	23
	Level 3:	15
	Level 4:	0
Career Field Agricultural and Environmental Systems. DOK Frequency	**Level 1:**	232
	Level 2:	486
	Level 3:	208
	Level 4:	11