

# HEALTH & BIO SCIENCES CAREER CLUSTER DESIGN

## Approved Pathway:

- 1) Includes minimum of three secondary-level credits.
- 2) Includes a work-based element.
- 3) Consists of a sequence: Introductory-level, Technical-level, and Application-level courses.
- 4) Supporting documentation includes Articulation Agreement(s), Certification, Program Improvement Plan, and a Program of Study.
- 5) Technical-level and Application-level courses receive .5 state-weighted funding in an approved CTE pathway.

## BioChemistry Pathway – CIP Code 14.1401

### INTRODUCTORY LEVEL

Environmental Science	03003	1 credit	Chemistry	03101	1 credit
Computing Systems (8-9)	10002/60002	1 credit	Φ●Engineering Applications	21002/71002	1 credit
Computer Applications (8-9)	10004/60004	1 credit	Φ●Engineering Technology	21003/71003	1 credit

### TECHNICAL LEVEL

Wildlife Management	18501	1 credit	Biotechnology in Agriculture	18308	1 credit
Marine Science	03005	1 credit	AP Environmental Science	03207	1 credit
IB Environmental Systems	03208	1 credit	Applied BioChemistry	03203	1 credit
●Human Body Systems or	14102	1 credit	Pharmacology	14253	1 credit
	03053	1 credit	Plant Science / Plant & Soil Science	18055/18058	1 credit
Anatomy & Physiology					
Environmental Law	04170	1 credit			

### APPLICATION LEVEL

Emerging Technologies in STEM	21053	1 credit	Project Management and Resource Scheduling	21205	1 credit
●BioEngineering or	21020	1 credit	Research in Environmental Science and Engineering	21016	1 credit
●Biotechnical Engineering	21014	1 credit	Environmental Resources and Wildlife Science	37506	1 credit
Natural Resources Management	18504	1 credit			
Workplace Experience	21048	1 credit			
Particular Topics in Engineering	21015	1 credit			

● Course appropriate for Project Lead the Way Programs; competencies may be utilized by any/all schools.  
 Φ Course appropriate for Engineering by Design Programs; competencies may be utilized by any/all schools

# KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE

## BIOCHEMISTRY PATHWAY (C.I.P. 14.1401)

STUDENT \_\_\_\_\_  
Rating Scale:

- 3 - Proficient Achievement
- 2 - Limited Achievement
- 1 - Inadequate Achievement
- 0 - No Exposure

# HEALTH & BIO SCIENCES CLUSTER

Graduation Date \_\_\_\_\_  
I certify that the student has received training in the areas indicated.

Instructor Signature \_\_\_\_\_

Instructor Signature \_\_\_\_\_

Instructor Signature \_\_\_\_\_

Instructor Signature \_\_\_\_\_

## COMMON CAREER TECHNICAL CORE – CAREER READY STANDARDS

1. Act as a responsible and contributing citizen and employee
2. Apply appropriate academic and technical skills
3. Attend to personal health and financial well-being
4. Communicate clearly, effectively and with reason
5. Consider the environmental, social and economic impacts of decisions
6. Demonstrate creativity and innovation
7. Employ valid and reliable research strategies
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management
10. Plan education and career path aligned to personal goals
11. Use technology to enhance productivity
12. Work productively in teams while

using cultural/global competence

## COMMON CAREER TECHNICAL CORE – STEM CLUSTER STANDARDS

1. Apply engineering skills in a project that requires project management, process control and quality assurance.
2. Use technology to acquire, manipulate, analyze and report data.
3. Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
4. Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
5. Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
6. Demonstrate technical skills needed in a chosen STEM field.

## INTRODUCTORY LEVEL COURSES

### 10004-Computer Applications

#### 3 2 1 0 1. Personal Information Management

- b. word usage, spelling, sentence structure, clarity, email
- c. Demonstrate knowledge of email etiquette.
- d. Send email messages.
- e. Access email attachments.
- f. Attach documents to messages.
- g. Demonstrate knowledge of contamination protection strategies for email.
- h. Save email messages / attachments.

#### 3 2 1 0 2. Research and Internet

- a. Locate information using search engine(s) and Boolean logic.
- b. Navigate web sites using software functions.
- c. Select appropriate search procedures and approaches.
- d. Select search engine(s) to use.
- e. Access business and technical information using the Internet.
- f. Access commercial, government, and education resources.
- g. Evaluate Internet resources (e.g., accuracy of information).

- h. Explore browser features.
- i. Test Internet connection.
- j. Unpack files using compression software.
- k. Bookmark web addresses (URLs).
- l. Navigate web sites using software functions (e.g., Forward, Back, Go To, Bookmarks).
- a. Create calendars/schedules.
- i. Document results.
- j. Create tasks (to-do) list.
- k. Identify PIM applications (MS Outlook, Lotus Notes, and others).
- l. Manage daily/weekly/monthly schedule using applications such as Notes, MS Outlook, etc.
- m. Create and send notes, informal memos, reminder using PIM applications.
- n. Create reminder for oneself.
- o. Access email messages received.
- p. Access email system using login and password functions.
- m. Create e-mail messages in accordance with established business standards (e.g., grammar, Access library catalogs on the Internet).
- n. Compile a collection of business sites (e.g., finance and investment).
- o. Add plug-ins and helpers to the web browser.
- p. Archive files.
- q. Explore the multimedia capabilities of the World Wide Web.
- r. Utilize online tools.
- s. Communicate via email using the Internet.
- t. Explore collaboration tools.
- u. Explore electronic commerce.
- v. Explore newsgroups.
- w. Compile a collection of business sites (e.g., finance and investment).

- 3 2 1 0 3. Word Processing and Presentations
- a. Create documents (e.g., letters, memos, reports) using existing forms and templates.
  - b. Employ word processing utility tools (e.g., spell checker, grammar checker, thesaurus).
  - c. Format text using basic formatting functions.
  - d. Retrieve existing documents.
  - e. Safeguard documents using name & save functions.
  - f. Create new word processing forms, style sheets, and templates.
  - g. Enhance publications using different fonts, styles, attributes, justification, etc.
  - h. Enhance publications using paint/draw functions.
  - i. Format new desktop publishing files.
  - j. Output desktop publishing files.
  - k. Place graphics in document.
  - l. Prepare publications using desktop publishing software.
  - m. Use advanced formatting features (e.g., headers/footers/dropped caps, and indexing).
  - n. Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication.
  - o. Edit presentations.
  - p. Insert graphic elements (e.g., graph, clip art, table) in a slide.
  - q. Identify hardware items that support presentation software (e.g., scanners, digital cameras, printers, and projection systems).
  - r. Print a single slide, an entire presentation, an outline, and notes.
  - s. Run slide shows manually and automatically.

- 3 2 1 0 4. Spreadsheets
- a. Create spreadsheets.
  - b. Edit spreadsheets.
  - c. Print spreadsheets.
  - d. Retrieve existing spreadsheets.
  - e. Save spreadsheets.
  - f. Create charts and graphs from spreadsheets.
  - g. Group worksheets.
  - h. Input/process data using spreadsheet functions.
  - i. Perform calculations using simple formulas.
- 3 2 1 0 5. Data
- a. Enter data using a form.
  - b. Locate/replace data using search and replace functions.
  - c. Process data using database functions (e.g., structure, format, attributes, relationships, keys).
  - d. Perform single- and multiple-table queries (e.g., create, run, save).
  - e. Print forms, reports, and results or queries.
  - f. Search a database table to locate records.
  - g. Sort data using single and multiple field sorts.
  - h. Verify accuracy of output.
  - i. Maintain shared database of contact information.
  - j. Manage daily/weekly/monthly schedule using applications.
  - k. Participate in virtual group discussions and meetings.
  - l. Apply basic commands of operating system software.
  - m. Employ desktop operating skills.
  - n. Apply appropriate file and disk management techniques.
  - o. Recognize the need for regular backup procedures.

- p. Demonstrate knowledge of central processing unit (CPU) control and architecture.
  - q. Identify CPU modes of operations.
  - r. Define the role of memory management in an operating system.
  - s. Demonstrate knowledge of network operating systems.
  - t. Demonstrate knowledge of operating system architecture types.
  - u. Demonstrate knowledge of the commands used to handle tasks in operating systems.
  - v. Differentiate between microcomputer, minicomputer, and mainframe operating systems.
  - w. Demonstrate knowledge of the basics of process management.
  - x. Demonstrate knowledge of the system utilities used for file management.
- 3 2 1 0 6. Ethics and Security
- a. Demonstrate knowledge of potential internal and external threats to security.
  - b. Assess exposure to security issues.
  - c. Demonstrate knowledge of virus protection strategy.
  - d. Ensure compliance with security rules, regulations, and codes.
  - e. Explore ways to implement countermeasures.
  - f. Implement security procedures in accordance with business ethics.
  - g. Maximize threat reduction.
  - h. Document security procedures.
  - i. Understand how to follow a disaster plan.
  - j. Identify sources of virus infections.
  - k. Understand how to utilize backup and recovery procedures.
  - l. Understand how to load virus detection and protection software.
  - m. Maintain confidentiality.

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- n. Understand how to provide for user authentication (e.g., assign passwords, access level).
  - o. Understand how to remove viruses.
  - p. Report viruses in compliance with company standards.
  - q. Identify the features and benefits of quality planning.
  - r. Identify the role of quality within the organization.
- 3 2 1 0 7. History / Quality Assurance
- a. Demonstrate knowledge of changes brought about by quality industry leaders in the world.
  - b. Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs.
  - c. Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000).
  - d. Demonstrate knowledge of the standards/requirements for the Baldrige award.
  - e. Demonstrate knowledge of quality management terminology.

## 10002 Computing Systems

- 3 2 1 0 1. Apply knowledge of operating systems principles to ensure optimal functioning of system.
- a. Interact with/respond to system messages using console device.
  - b. Apply basic commands of operating system software.
  - c. Apply appropriate file and disk management techniques.
  - d. Employ desktop operating skills.
  - e. Follow power-up and log-on procedures.
  - f. Run applications. jobs in accordance with processing procedures.

- g. Follow log-off and power-down procedure(s).
  - h. Handle materials and equipment in a responsible manner.
- 3 2 1 0 2. Clearly document procedures for future use.
- a. Document step-by-step installation and configuration procedures.
- 3 2 1 0 3. Communicate and recognize goal achievement.
- a. Communicate goal achievement.
  - b. Provide recognition for goal achievement.
- 3 2 1 0 4. Configure systems to provide optimal system interfaces.
- a. Apply concepts of privileged instructions and protected mode programming.
  - b. Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network).
  - c. Allocate disk space, non-sharable resources, and I/O devices.
  - d. Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures).
  - e. Identify standards and issues related to I/O programming and design of I/O interfaces.
  - f. Define hardware-software interface issues for a computer system.
  - g. Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats).
- 3 2 1 0 5. Configure/modify system as needed.
- a. Build system software command structures using operating system macro facilities for computer systems.
  - b. Identify scheduling priority in programming.

- c. Identify data requirements.
  - d. Review automated scheduling software.
  - e. Secure needed supplies and resources.
- 3 2 1 0 6. Determine audience and information needs
- a. Define research questions.
  - b. Identify target audience.
- 3 2 1 0 7. Document procedures and actions.
- a. Develop audit trails.
- 3 2 1 0 8. Ensure that hardware and software system components are compatible prior to performing installation.
- a. processor, memory, disk space, communications, printers, monitors).
  - b. Determine compatibility of hardware and Identify hardware requirements (e.g., software.
- 3 2 1 0 9. Ensure that software to be installed is licensed prior to performing installation.
- a. Verify conformance to licensing agreement.
- 3 2 1 0 10. Evaluate information systems problem-solving techniques and approaches.
- a. Evaluate systems engineering considerations.
  - b. Identify potential problems in system implementation.
  - c. Summarize application planning, development, and risk management for information system.
  - d. Demonstrate knowledge of critical thinking skills and techniques.
  - e. Demonstrate knowledge of decision-making skills and techniques.
  - f. Develop a plan using data-oriented techniques.
  - g. Determine whether prototyping system is feasible.
  - h. Determine software design process, from specification to implementation.
  - i. Appraise software process and product life-cycle models.
  - j. Assess software design methods and tools.

- 3 2 1 0 11. Evaluate information.
- a. Determine the accuracy and completeness of the information gathered.
- 3 2 1 0 12. Explain data communications procedures, equipment and media.
- a. Demonstrate knowledge of the uses of data communications media.
  - b. Demonstrate knowledge of the uses of data communications equipment.
  - c. Demonstrate knowledge of key communications procedures.
- 3 2 1 0 13. Explain measurement techniques for increased productivity due to information systems implementation.
- a. Measure increases in productivity realized by the implementation of information systems.
- 3 2 1 0 14. Explain new and emerging classes of software.
- a. Identify new and emerging classes of software.
- 3 2 1 0 15. Explain the benefits of hosting a web site on a local server vs. at an ISP (Internet Service Provider).
- a. Compare the advantages and disadvantages of running your own server vs. using a server provider.
- 3 2 1 0 16. Explain the differences between local and wide area networks.
- a. Distinguish between local area networks and wide area networks.
- 3 2 1 0 17. Explain the features and functions of web browsing software.
- a. Identify how different browsers affect the look of a web page.
  - b. Demonstrate knowledge of the characteristics and uses of plug-ins.
  - c. Demonstrate knowledge of the role of browsers in reading files on the World Wide Web (text-only, hypertext).

- 3 2 1 0 18. Explain the features and functions of web page design software.
- a. Compare/contrast the features and functions of software editors available for designing web pages.
- 3 2 1 0 19. Explain the key functions and applications of software.
- a. Demonstrate knowledge of the function and operation of compilers and interpreters.
  - b. Demonstrate knowledge of widely used software applications (e.g., word processing, database management, spreadsheet development).
  - c. Demonstrate knowledge of the key functions of systems software.
- 3 2 1 0 20. Explain the role of number systems in information systems.
- a. Identify the role the binary system in information systems.
  - b. Demonstrate knowledge of number systems and internal data representation.
- 3 2 1 0 21. Gather information.
- a. Identify potential sources of information.
  - b. Gather information from selected print and electronic sources.
  - c. Conduct interviews with selected human information sources.
  - d. Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).
  - e. Target audience/user group as a key information source.
  - f. Determine priorities for the information that should be gathered.
  - g. Identify subject-matter experts.
- 3 2 1 0 22. Identify computer classifications and hardware.
- a. Identify types of computer storage devices.
  - b. Identify the hardware associated with telecommunications functions.
  - c. Identify major hardware components and their functions.

- d. Identify the three main classifications of computers (i.e. micro-, mid-range, & mainframe).
- 3 2 1 0 23. Identify new IT technologies and assess their potential importance and impact on the future.
  - a. Identify new technologies relevant to information technology.
  - b. Assess the importance of new technologies to future developments & to future knowledge worker productivity.
  - c. Identify new & emerging drivers and inhibitors of information technology change.
- 3 2 1 0 24. Monitor and adjust goals.
  - a. Obtain support for goals.
  - b. Provide support for goals.
  - c. Monitor goal achievement.
  - d. Adjust goals.
- 3 2 1 0 25. Operate computer-driven equipment and machines.
  - a. Run applications/jobs in accordance with processing procedures.
  - b. Secure needed supplies and resources.
  - c. Interact with/respond to system messages using console device.
  - d. Follow log-off and power-down procedure(s).
  - e. Follow power-up and log-on procedures.
- 3 2 1 0 26. Perform customization as requested.
  - a. Customize software to meet user preferences.
- 3 2 1 0 27. Perform installation accurately and completely, using available resources as needed.
  - a. Select appropriate installation options (e.g., default, customized).
  - b. Configure software to appropriate operating system settings.
  - c. Configure macros, tools, and packages to accomplish simple organizational and personal tasks.
  - d. Differentiate between procedures for an upgrade and for a new installation.

- e. Differentiate between stand-alone and network installation procedures.
- f. Disable/uninstall software that may interfere with installation of new software.
- g. Install given application/system software on various platforms in accordance with manufacturer's procedures.
- h. Convert data files if required.
- i. Verify software installation and operation.
- 3 2 1 0 28. Resolve problems with installation if they occur.
  - a. Access needed help using manufacturers' technical help lines or Internet sites.
  - b. Formulate new installation procedure if needed.
  - c. Troubleshoot unexpected results.
  - d. Set short- and long-term goals for assigned areas of responsibility/accountability.
- 3 2 1 0 29. Test and maintain products / services.
  - a. Test products for reliability.
  - b. Initiate predictive maintenance procedures.
- 3 2 1 0 30. Troubleshoot computer-driven equipment and machines and access support as needed
  - a. Test system using diagnostic tools/software.
  - b. Repair/replace malfunctioning hardware.
  - c. Reinstall software as needed.
  - d. Recover data and/or files.
  - e. Restore system to normal operating standards.
- 3 2 1 0 31. Understand and employ design and color principles.
  - a. Assess the impact of various color harmonies on a two-dimensional picture plan.
  - b. Demonstrate knowledge of the two-dimensional picture plan.
  - c. Demonstrate knowledge of the nature of color and color harmonies.
  - d. Assess how color affects the principles of line, value, shape and form.
  - e. Demonstrate knowledge of the principles and elements of design and their relationship to each other.

- 3 2 1 0 32. Understand data communications trends and issues.
  - a. Identify major current issues in data communications.
  - b. Identify data communication trends.
  - c. Demonstrate knowledge of data transmission codes and protocols.
- 3 2 1 0 33. Understand elements and types of information processing.
  - a. Identify the elements of the information processing cycle (i.e., input, process, output, and storage).
  - b. Identify types of processing (e.g., batch, interactive, event-driven, object-oriented).
- 3 2 1 0 34. Understand functions and interactions of departments within a business.
  - a. Identify the ways in which organizational functions are interdependent.
  - b. Define the role of strategic planning in business.
  - c. Identify types of communication channels (e.g., formal, informal).
  - d. Demonstrate knowledge of the components of a business plan.
- 3 2 1 0 35. Understand how bandwidth affects data transmission and on-screen image.
  - a. Demonstrate knowledge of how bandwidths affect data transmission and on-screen image.
- 3 2 1 0 36. Understand how data is organized in software development.
  - a. Demonstrate knowledge of how data is organized in software development.
- 3 2 1 0 37. Understand information organization principles.
  - a. Demonstrate knowledge of group support technology for common knowledge requirements.
  - b. Demonstrate knowledge of methods for achieving productivity in knowledge work.
  - c. Demonstrate knowledge of the information analysis process.
  - d. Demonstrate knowledge of information technology solutions.

- 3 2 1 0 38. Understand product/service design.
- Consider customer satisfaction in determining product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation).
  - Design product (e.g., using brainstorming, thumbnail sketches, rendering).
- 3 2 1 0 39. Understand the differences between a client and a server.
- Differentiate between a client and a server.
- 3 2 1 0 40. Understand the fundamentals of operating systems.
- Identify major operating system fundamentals and components.
- 3 2 1 0 41. Understand the range of languages used in software development.
- Demonstrate knowledge of the range of languages used in software development.
- 3 2 1 0 42. Understand types and functions of businesses.
- Define stakeholder relationships (e.g., customers, employees, shareholders, and suppliers).
  - Identify business reporting and information flow.
  - Identify types of business organizations and functions.
- 3 2 1 0 43. Use available reference tools as appropriate.
- Access needed information using appropriate reference materials.
  - Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts).
- 3 2 1 0 44. Use installation and operation manuals.
- Access needed information using appropriate reference materials.

- 3 2 1 0 45. Use reliability factors effectively to plan for and create products/ services.
- Consider reliability factors (e.g., cost, human, productivity).
  - Achieve reliability through maintainability, good design, design simplification, and design redundancy.
  - Recognize the relationship of maintainability and reliability.
  - Align cost components with quality objectives.
  - Classify quality costs (e.g., preventive, evaluation, pre-delivery failures, post-delivery failures).

## 21002 Engineering Applications

### Design and Modeling

- 3 2 1 0 1. Explain the relationship between science, technology, engineering and math.
- 3 2 1 0 2. Describe engineering and explain how engineers participate in or contribute to the invention and innovation of products.
- 3 2 1 0 3. Describe impacts that technology has had on society.
- 3 2 1 0 4. Distinguish between invention and innovation.
- 3 2 1 0 5. Assemble an engineering notebook and a portfolio.
- 3 2 1 0 6. Describe the design process and how it is used to aid in problem solving.
- 3 2 1 0 7. Use the design process to solve a technical problem.
- 3 2 1 0 8. Recognize design criteria and constraints.
- 3 2 1 0 9. Describe the purpose and importance of working in a team.
- 3 2 1 0 10. Explain a design brief and apply the concept when using the design process.
- 3 2 1 0 11. Describe the elements of design and apply this concept to the design process.
- 3 2 1 0 12. Use a decision matrix to select the best solution to a design problem.

- 3 2 1 0 13. Demonstrate the ability to measure accurately with different devices and scales.
- 3 2 1 0 14. Explain how to measure in different contexts.
- 3 2 1 0 15. Measure using both the English and Metric systems.
- 3 2 1 0 16. Summarize the reasoning for using sketching as a communication tool.
- 3 2 1 0 17. Use visualization, spatial reasoning, and geometric shapes to sketch two and three dimensional shapes.
- 3 2 1 0 18. Recognize and create thumbnail, perspective, isometric, and orthographic sketches.
- 3 2 1 0 19. Recognize and accurately interpret one and two point perspective drawings.
- 3 2 1 0 20. Communicate ideas for a design using various sketching methods, notes, and drafting views.
- 3 2 1 0 21. Dimension an orthographic sketch following the guidelines of dimensioning.
- 3 2 1 0 22. Create a three-dimensional (3D) model of an object.
- 3 2 1 0 23. Apply geometric and dimension constraints to design CAD-modeled parts.
- 3 2 1 0 24. Assemble the product using the CAD modeling program.
- 3 2 1 0 25. Demonstrate the ability to produce various annotated working drawings of a 3D model.
- 3 2 1 0 26. Identify the difference between a prototype, a model and a mock-up and analyze what circumstances call for the use of each.
- 3 2 1 0 27. Explain why teams of people are used to solve problems.
- 3 2 1 0 28. Brainstorm and sketch possible solutions to an existing design problem.



- 3 2 1 0 29. Create a decision-making matrix.
- 3 2 1 0 30. Select an approach that meets or satisfies the constraints given in a design brief.

#### **Automation and Robotics**

- 3 2 1 0 31. Describe the purpose of automation and robotics and its effect on society.
- 3 2 1 0 32. Summarize ways that robots are used in today's world and the impact of their use on society.
- 3 2 1 0 33. Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- 3 2 1 0 34. Investigate a career related to automation and robotics and determine the requirements for entering the field.
- 3 2 1 0 35. Investigate and understand various mechanisms to determine their purpose and applications.
- 3 2 1 0 36. Be able to apply their knowledge of mechanisms to solve a unique problem.
- 3 2 1 0 37. Design, build, wire, and program both open and closed loop systems.
- 3 2 1 0 38. Troubleshoot a malfunctioning system using a methodical approach.
- 3 2 1 0 39. Experience fluid power by creating and troubleshooting a pneumatic device.
- 3 2 1 0 40. Design, build, wire and program a system operated by alternative energy.

#### **Energy and the Environment (optional/extension)**

- 3 2 1 0 41. Differentiate between potential and kinetic energy.
- 3 2 1 0 42. Explain the differences, advantages, and disadvantages between exhaustible, inexhaustible, renewable, and non-renewable energy sources.

**Specific curriculum will differ from program to program. Additional topics of study can include:**

- Efficiency vs. Conservation and measures to address each

- Water Conservation and Management
- Energy Budget and Fiscal Impact
- Geographic Barriers and Availability Considerations of Resources
- Power, Work, and Measure of Energy
- Trends of Consumption of Various Energy Sources
- Environmental Impact of Energy Usage and Disposal

## **21003 Engineering Technology**

### **Flight and Space**

- 3 2 1 0 1. Apply their knowledge of research techniques to investigate the history of an aerospace vehicle.
- 3 2 1 0 2. Experience the flight characteristics of kites, whirly gigs, model airplanes, hot air balloons, and model rockets.
- 3 2 1 0 3. Utilize language arts skills to write a script and create a storyboard for an infomercial promotion of an aerospace vehicle.
- 3 2 1 0 4. Distinguish between the forces of lift, drag, weight, and thrust that affect an object moving through a fluid. Understand the importance of each force.
- 3 2 1 0 5. Examine how center of gravity affects an aerospace vehicle in distributing weight.
- 3 2 1 0 6. Discover how Newton's laws apply to flight and space.
- 3 2 1 0 7. Discover Bernoulli's principle through exploration.
- 3 2 1 0 8. Recognize the tools and purpose of aeronautic design and testing.
- 3 2 1 0 9. Identify the characteristics of an airfoil and how they compare and contrast with the characteristics of wings.
- 3 2 1 0 10. Analyze the features and benefits of different types of wings.

- 3 2 1 0 11. Describe the major parts (fuselage, empennage, high lift devices, wings, undercarriage, propulsion, instruments, and controls) of aircraft and how they can affect the overall balance of an airplane during flight.
- 3 2 1 0 12. Research and design an airfoil and empennage for use in the prototyping of a Styrofoam glider.
- 3 2 1 0 13. Explore the history and development of rocketry, space flight, and living in space.
- 3 2 1 0 14. Discover the basic principles of flight and rocketry.
- 3 2 1 0 15. Investigate how changes in various design characteristics of a rocket will affect the rocket's performance.
- 3 2 1 0 16. Know that a rocket must overcome the forces of gravity and drag in order to get out of the atmosphere.
- 3 2 1 0 17. Understand that an orbit is the balance of gravity and an object's tendency to follow a straight path.
- 3 2 1 0 18. Use an immersive learning simulation to select optimal components for a lunar robot's engine, power source, tires, body type and sensor system to save stranded astronauts on the moon.
- 3 2 1 0 19. Understand the challenges that engineers face to provide safe travel and optimum living conditions in space.

### **Science of Technology**

- 3 2 1 0 20. Describe the difference between a chemist and a chemical engineer.
- 3 2 1 0 21. Apply science and engineering skills to make ice cream.
- 3 2 1 0 22. Follow the design process to create an adhesive.
- 3 2 1 0 23. Work with a team to solve an oil spill engineering simulation problem.
- 3 2 1 0 24. Demonstrate an understanding of how small a nanometer is.



- 3 2 1 0 25. Explore how nano-products are used in society today.
- 3 2 1 0 26. Identify tools and processes used to see and manipulate matter at the nanoscale.
- 3 2 1 0 27. Discuss the impact that nanotechnology has on their lives today and will have in the future.
- 3 2 1 0 28. Correctly identify the six simple machines and explain their applications.
- 3 2 1 0 29. Distinguish between the three classes of levers.
- 3 2 1 0 30. Identify a machine as something that helps use energy more efficiently.
- 3 2 1 0 31. Determine mechanical advantage from assembled simple machines.
- 3 2 1 0 32. Be able to compare and contrast kinetic and potential energy.
- 3 2 1 0 33. Predict the relative kinetic energy based on the mass and speed of the object.
- 3 2 1 0 34. Recognize and follow safety rules for using lab tools and machines.
- 3 2 1 0 35. Build, test, and evaluate a model of a design problem.
- 3 2 1 0 36. Analyze a product through testing methods and make modifications to the product.

**Magic of Electrons**

- 3 2 1 0 37. Identify the roles of protons, neutrons, and electrons in an atom.
- 3 2 1 0 38. Identify an element based on the atomic number.
- 3 2 1 0 39. Identify metals, metalloids, and non-metals on the periodic table.
- 3 2 1 0 40. Judge whether a material is a conductor, insulator, or semiconductor based upon its number of valence electrons and its position on the periodic table.

- 3 2 1 0 41. Explain how the Law of Charges holds an atom together.
- 3 2 1 0 42. Explain how electrons transfer from one atom to another to create electron flow.
- 3 2 1 0 43. Define current, voltage, and resistance.
- 3 2 1 0 44. Measure voltage and current using a multimeter.
- 3 2 1 0 45. Understand the properties of a magnet.
- 3 2 1 0 46. Build an electromagnet to demonstrate its characteristics and functions.
- 3 2 1 0 47. Build a DC motor to identify the primary parts and demonstrate how it functions.
- 3 2 1 0 48. Build a generator to identify the primary parts and demonstrate how it functions.
- 3 2 1 0 49. Understand the role of an electromagnet in the function of a DC motor and generator.
- 3 2 1 0 50. Compare the characteristics of a basic motor and generator.
- 3 2 1 0 51. Build series, parallel, and combination electrical circuits.
- 3 2 1 0 52. Create circuit diagrams using standardized schematic symbols.
- 3 2 1 0 53. Build and test physical electrical circuits based upon circuit diagrams.
- 3 2 1 0 54. Integrate DC sources, lamps, switches, diodes, light emitting diodes, resistors, and capacitors into electrical circuits to achieve specific functions.
- 3 2 1 0 55. Distinguish between the functions and operations of fixed resistors, variable resistors, and photo resistors.
- 3 2 1 0 56. Determine the value of a fixed resistor based upon the color codes on those resistors.
- 3 2 1 0 57. Measure voltage, current, and resistance using a multimeter.
- 3 2 1 0 58. Mathematically calculate voltage, current, and resistance using Ohm's law.

- 3 2 1 0 59. Create a circuit that uses a transistor as a switch.
- 3 2 1 0 60. Interpret logic scenarios to determine outputs based upon possible conditions within those scenarios.
- 3 2 1 0 61. Distinguish between the functions of NOT, AND, OR, NAND, NOR, and XOR gates.
- 3 2 1 0 62. Create truth tables for logic scenarios and match those gates to truth tables.
- 3 2 1 0 63. Convert binary numbers to Base-10.
- 3 2 1 0 64. Convert ASCII characters to binary.
- 3 2 1 0 65. Create a digital wave form and graph it for a binary sequence.
- 3 2 1 0 66. Communicate using electronic circuit diagrams.
- 3 2 1 0 67. Use transistors as switches to create circuits that function as AND and OR gates.
- 3 2 1 0 68. Determine the logic, sensors, gates, outputs, and other components needed to emulate existing electronic devices that utilize logic.
- 3 2 1 0 69. Design, construct, and test device solutions for emulating common electronic devices that utilize logic.

**03003 Environmental Science**

- 3 2 1 0 1. Define environmental problems facing the world (i.e., Overpopulation, pollution, resource depletion)
- 3 2 1 0 2. Identify the components of an ecosystem.
- 3 2 1 0 3. Explain food relationships (i.e., food web, trophic levels, biomass pyramid)
- 3 2 1 0 4. Explain the relationship between energy and nutrients (e.g. energy flow, nutrient cycling)
- 3 2 1 0 5. Explain interspecies relationships (e.g., parasitism, predator-prey, commensalism, mutualism, competition, herbivory)

- 3 2 1 0 6. Comprehend population dynamics (e.g., population size (N), population density, population growth, carrying capacity, biotic potential, environmental resistance)

#### **Water Cycle**

- 3 2 1 0 7. Outline the water treatment process (i.e., aeration, sedimentation, filtration, disinfection)
- 3 2 1 0 8. Perform water testing activities (e.g., hardness, turbidity, coliform, pH, minerals)
- 3 2 1 0 9. Paraphrase EPA water quality standards

#### **Human Impact On The Environment**

- 3 2 1 0 10. Outline human population growth characteristics (e.g., pattern over history, recent explosion, changes in birth and death rates)
- 3 2 1 0 11. Explain the importance of population demographics (e.g., population size, density, total fertility rate)
- 3 2 1 0 12. Predict the environmental consequences of population explosion in developing countries
- 3 2 1 0 13. Summarize how changes in food production has affected population growth (i.e., Early agriculture, 1st Agricultural Revolution, 2nd Agricultural Revolution, Hybrid crops and the Green Revolution, Polyculture to Monoculture, Factory Farms)
- 3 2 1 0 14. Predict impact of soil degradation on human population (e.g., physical degradation: erosion, soil compaction; chemical degradation: salinization, nutrient depletion, over fertilization, pesticides.)
- 3 2 1 0 15. Predict what sustainable agriculture might look like (wind breaks, filter strips, contour plowing, crop rotation, cover crops and crop residues, trickle-drip irrigation, organic farming)

#### **Importance of Water**

- 3 2 1 0 16. Explain basic water chemistry
- 3 2 1 0 17. Identify sources of water
- 3 2 1 0 18. Diagram the water cycle
- 3 2 1 0 19. Summarize uses of water
- 3 2 1 0 20. Recognize water pollution
- 3 2 1 0 21. Major types of pollutants- pathogens, inorganic chemicals, organic chemicals, radioactive materials
- 3 2 1 0 22. Pollutants that cause ecosystem disruption- sediments, plant nutrients, oxygen demanding wastes, thermal
- 3 2 1 0 23. Outline drinking water treatment processes
- 3 2 1 0 24. Explain laws related to drinking water (i.e., Safe Drinking Water Act, Clean Water Act)

#### **Soil**

- 3 2 1 0 25. Describe soil properties (i.e., permeability, capillary water, soil texture, pH)

#### **Biodiversity**

- 3 2 1 0 26. Recall definitions for changes in wildlife status (i.e., endangered, threatened, extirpation)
- 3 2 1 0 27. Analyze causes of extinction
- 3 2 1 0 28. Identify the importance of terms used to describe habitat fragmentation and edges (e.g., area, perimeter, safe area, effect on interior vs. edge species)
- 3 2 1 0 29. Describe efforts to preserve biological diversity (e.g., Endangered Species Act, Convention on International Trade in Endangered Species (CITES), World Conservation Union, Hunting and Fishing Organizations, Zoos and Nature Preserves)

#### **Biomes**

- 3 2 1 0 30. Define climate and ecosystems terms (i.e., temperature, rainfall, climate graphs)
- 3 2 1 0 31. Illustrate a map of the world showing geographical distribution of ecosystems
- 3 2 1 0 32. Recall the relationship between elevation and ecosystems

- 3 2 1 0 33. Label the world biomes on a map (i.e., temperate forest, boreal forest, tropical rainforest, temperate rainforest, shrublands, and grasslands: prairies and savannas, tundra, desert)

#### **Air Resources**

- 3 2 1 0 34. Explain the parts of the atmosphere (i.e., troposphere, stratosphere, mesosphere, thermosphere)
- 3 2 1 0 35. Describe the effects of major air pollutants (e.g., suspended particulate matter, volatile organic compounds, Nitrogen Oxides, Sulfur Dioxide, lead, ozone)
- 3 2 1 0 36. Explain the causes of stratospheric ozone depletion (e.g., UV radiation, CFC's, Montreal Protocol)
- 3 2 1 0 37. Summarize the Greenhouse effect and global climate change using appropriate terminology (e.g., greenhouse gases, changes in surface temperatures, changes in organism distribution, melting ice and rising sea levels, changing rainfall patterns, Kyoto Protocol)

#### **Energy**

- 3 2 1 0 38. Identify energy resources (i.e., fossil fuels, ways to generate electricity (coal, nuclear, hydropower, wind), renewable vs. Nonrenewable)
- 3 2 1 0 39. Explain forms of energy consumption (e.g., personal uses of energy, changes in energy use over time)
- 3 2 1 0 40. Define energy reserves (e.g., proven vs. Potential, technologically and economically feasible, conventional and nonconventional)
- 3 2 1 0 41. Outline causes of pollution caused by searches for energy (i.e., strip mining, deep mining, mountain top removal/valley fills, habitat destruction)
- 3 2 1 0 42. Predict the impact of future sources of energy on the environment (e.g., Geo-engineering, Alternatives: nuclear, hydropower, solar, wind, hydrogen fuel cells, bio-fuels, thermal conversion, anaerobic digester "cow power")

## Hazardous Substances

- 3 2 1 0 43. Give an example of the Estrogen Effect
- 3 2 1 0 44. Define Hazardous Materials (HAZMAT)
- 3 2 1 0 45. Gives an example of HAZMAT “accidents” (e.g., Bhopal, India, Love Canal)
- 3 2 1 0 46. Recognize significant legislation regulations (e.g., Superfund (CERCLA), Emergency Planning and Community Right-to-Know Act (EPCRA), Resource Conservation and Recovery Act (RCRA))
- 3 2 1 0 47. Explain several methods of disposal of HAZMAT (e.g., deep well injection, surface impoundment, landfill, incineration, bioremediation, chemical neutralization, source reduction)

## 03101 Chemistry

- HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
- HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

- HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.\*
- HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.\*
- HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
- HS-PS4-5. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

## TECHNICAL LEVEL COURSES

### 18501 Wildlife Management

- 3 2 1 0 1. Describes the differences between domesticated animals and wildlife animals
- 3 2 1 0 2. Identify common wildlife species based on wildlife signs including fur, hair, feathers, gnawing, nests, rubbings, pellets, tracks, bird calls, and scat from list provided
- 3 2 1 0 3. Identify basic wildlife survival needs
- 3 2 1 0 4. Describe predator-prey relationships and examples
- 3 2 1 0 5. Describe the potential impact of the introduction of non-native species
- 3 2 1 0 6. Describe the major factors affecting threatened and endangered species and methods used to improve the populations of these species
- 3 2 1 0 7. Describe ways habitat can be improved for specific species by knowing their requirements
- 3 2 1 0 8. Discuss the concepts of carrying capacity and limiting factors
- 3 2 1 0 9. Analyze various ways the public and wildlife managers can help in the protection, conservation, and management of wildlife species
- 3 2 1 0 10. Evaluate a given habitat for its suitability for designated species, given a description of their habitat needs
- 3 2 1 0 11. List legal regulations that apply to hunting and trapping
- 3 2 1 0 12. Describe how hunting regulates animal populations
- 3 2 1 0 13. Outline revisions or changes in hunting and trapping regulations or seasons and in animal management programs so that wildlife balances and habitats can be maintained in a theoretical situation
- 3 2 1 0 14. Describe hunter and trapper safety training

- 3 2 1 0 15. Interpret information about regulations such as those concerning environmental protection, resource utilization, fire safety and accident prevention.
- 3 2 1 0 16. Define a wetland
- 3 2 1 0 17. Explain how a wetland is formed
- 3 2 1 0 18. Summarize the diversity of wetlands
- 3 2 1 0 19. Illustrates the substrate of wetlands
- 3 2 1 0 20. Labels various plant life forms native to wetlands.
- 3 2 1 0 21. Describes the nutrient and energy flow in a wetland area.
- 3 2 1 0 22. Summarizes common food chains and food webs within a wetland area.
- 3 2 1 0 23. Explains the methods animals used to adapt to wetland areas.
- 3 2 1 0 24. Contrasts various wetland types (e.g., Freshwater marshes, lakeshore marshes, riverine, coastal marshes, estuaries, bottomland hardwoods, tundra)
- 3 2 1 0 25. Identifies the dominant animals of wetlands (i.e. Birds, mammals, fishes, herptiles)
- 3 2 1 0 26. Explains wetland management and restoration considerations.
- 3 2 1 0 27. Relates the impact of wetland elimination on humanity.
- 3 2 1 0 28. Distinguishes between game management and wildlife management
- 3 2 1 0 29. Examine the role of Kansas wildlife and Kansas wildlife agencies through an introduction to wildlife management and recreation principles
- 3 2 1 0 30. Examine Kansas game management principles and practices to conserve and protect wildlife.
- 3 2 1 0 31. Analyze the importance of public education and information in wildlife management and recreation.
- 3 2 1 0 32. Evaluate practices a landowner can use to improve wildlife habitat and profit.

- 3 2 1 0 33. Analyze the effects of game laws and their enforcement on sustainable wildlife and recreation activities.
- 3 2 1 0 34. Assess fishery management principles designed to promote and sustain an abundant and healthy supply of fish.
- 3 2 1 0 35. Analyze the important recreational, therapeutic, ecological, and environmental values of Kansas parks to the public

## 03005 Marine Science

- 3 2 1 0 1. Monitor environments, including chemical analysis of the water, to ensure maintenance of optimum conditions for aquatic life.
- 3 2 1 0 2. Collect information regarding techniques for fish collection and fertilization, spawn incubation and treatment of spawn and fry.
- 3 2 1 0 3. Identify environmental requirements of a particular species, and select sites for species cultivation
- 3 2 1 0 4. Use a variety of sampling methods to estimate population sizes of aquatic organisms
- 3 2 1 0 5. Analyze biodiversity of ecosystems as an indicator of ecosystem health
- 3 2 1 0 6. Study aquatic animals, assessing effects of environment and industry on them, interpreting findings and recommending alternative conditions that industry could change to protect their environment
- 3 2 1 0 7. Identify impact of external factors on sub-ecosystem health (pollution, temperature, species invasion, etc.)
- 3 2 1 0 8. Disseminate information by writing reports and/or papers or journal articles, and by making presentations and giving talks for classes, clubs, and interested groups
- 3 2 1 0 9. Study characteristics of aquatic animals such as origin, interrelationships, classification, life histories and diseases, development, genetics, and distribution

- 3 2 1 0 10. Prepare charts or graphs from data samples, providing summary information on the environmental relevance of the data
- 3 2 1 0 11. Determine data collection methods to be employed in research projects and surveys
- 3 2 1 0 12. Conduct site assessments to certify a habitat or to ascertain environmental damage or restoration needs

## 03208 IB Environmental Systems

### Systems & Models

- 3 2 1 0 1. Outline the concept and characteristics of a system
- 3 2 1 0 2. Define the terms open system, closed system, and isolated system
- 3 2 1 0 3. Describe how the first and second laws of thermodynamics are relevant to environmental systems
- 3 2 1 0 4. Explain the nature of equilibria
- 3 2 1 0 5. Define and explain the principles of positive feedback and negative feedback
- 3 2 1 0 6. Describe transfer and transformation processes
- 3 2 1 0 7. Distinguish between flows (inputs and outputs) and storages (stock) in relation to systems
- 3 2 1 0 8. Analyze quantitative models involving flows and storages in a system

### Ecosystems

- 3 2 1 0 9. Distinguish between biotic and abiotic (physical) components of an ecosystem
- 3 2 1 0 10. Define the trophic level
- 3 2 1 0 11. Identify and explain trophic levels in food chains and food webs selected from the local environment
- 3 2 1 0 12. Explain the principles of pyramids of numbers, pyramids of biomass and pyramids of productivity, and construct such pyramids from given data
- 3 2 1 0 13. Discuss how the pyramid structure affects the functioning of an ecosystem

- 3 2 1 0 14. Define the terms: species, population, community, niche and habitat with reference to local examples
- 3 2 1 0 15. Define the term biome
- 3 2 1 0 16. Outline the distribution, and relative productivity of tropical rain forests, deserts, temperate forests, tundra and any one other biome
- 3 2 1 0 17. Describe and explain population interactions using examples of names species
- 3 2 1 0 18. Explain the role of producers, consumers, and decomposers in the ecosystem
- 3 2 1 0 19. Describe photosynthesis and respiration in terms of inputs, outputs and energy transformations
- 3 2 1 0 20. Explain the terms negative feedback mechanism and positive feedback mechanism in relation to ecosystems
- 3 2 1 0 21. Explain the concepts of limiting factors and carrying capacity in the context of population growth
- 3 2 1 0 22. Describe the concept and processes of succession in a named habitat
- 3 2 1 0 23. Describe factors affecting the nature of climax communities

#### **Atmosphere**

- 3 2 1 0 24. Describe the overall structure and composition of the atmosphere and outline the concept of lapse rate
- 3 2 1 0 25. Explain the role of atmospheric circulation in redistributing heat from the equator to polar regions
- 3 2 1 0 26. Explain how atmospheric circulation gives rise to broad climatic regions, and, consequently, biomes
- 3 2 1 0 27. Describe the role of greenhouse gases in maintaining mean global temperature
- 3 2 1 0 28. Describe how human activities add to greenhouse gases
- 3 2 1 0 29. Outline the chemistry leading to the formation of acidified precipitations

- 3 2 1 0 30. Outline the role of ocean currents in the global transfer of energy
- 3 2 1 0 31. Describe the El Nino Southern Oscillation (ENSO) phenomenon and its impacts
- 3 2 1 0 32. Describe the structure of the Earth's internal zones and the theory of plate tectonics
- 3 2 1 0 33. Outline how soil systems integrate aspects of living systems
- 3 2 1 0 34. Outline the processes that cause soil degradation

#### **Human Population**

- 3 2 1 0 35. Describe the concept of resources in terms of natural capital
- 3 2 1 0 36. Define the terms renewable, replenish-able and non-renewable natural capital
- 3 2 1 0 37. Explain the difficulties in applying the concept of carrying capacity to local human populations
- 3 2 1 0 38. Describe and explain the relationship between population, resource consumption and technological development, and their influence on carrying capacity and material economic growth

#### **Ecosystems**

- 3 2 1 0 39. Describe and evaluate methods for estimating the biomass of trophic levels in a community
- 3 2 1 0 40. Describe and evaluate methods for measuring changes in abiotic and biotic components of an ecosystem due to a specific human activity
- 3 2 1 0 41. Define the term *diversity*

#### **Conservation & Biodiversity**

- 3 2 1 0 42. Define the terms: biodiversity, genetic diversity, species diversity and habitat diversity
- 3 2 1 0 43. Explain the relationships among ecosystem stability, diversity, succession and habitat
- 3 2 1 0 44. Describe and explain the factors that lead to loss of diversity
- 3 2 1 0 45. State and explain the criteria used to determine a species; conservation status

## **14102 Human Body Systems**

- 3 2 1 0 1. Explain the functions of different human body systems, and lists the major organs within each system
- 3 2 1 0 2. Describe how multiple body systems are interconnected and how those interconnections and interactions are necessary for life
- 3 2 1 0 3. Describe the differences in the appearance of epithelial and connective tissue
- 3 2 1 0 4. Explain the basic structure and function of the skeletal system
- 3 2 1 0 5. Describe how bone markings, bone landmarks and bone measurements can provide information about gender, race, ethnicity and height of a missing person
- 3 2 1 0 6. Describe how the structure of DNA is linked to function in the body
- 3 2 1 0 7. Explain how restriction enzymes cut DNA
- 3 2 1 0 8. Define Biometrics
- 3 2 1 0 9. Identify how gel electrophoresis results can help solve a missing persons' case
- 3 2 1 0 10. Outline the structure and function of the central nervous system
- 3 2 1 0 11. Summarize the techniques scientists use to map brain function
- 3 2 1 0 12. Correctly predict how electrical signals are created and transmitted in the human body
- 3 2 1 0 13. Summarize the roles of ions in creating electrical impulses in the human body
- 3 2 1 0 14. Explain how neurotransmitters help propagate electrical impulses
- 3 2 1 0 15. Describe the way in which hormones interact with target cells
- 3 2 1 0 16. Differentiate between endocrine and exocrine glands as well as protein/peptide and steroid hormones



- 3 2 1 0 17. Illustrate how the structure of the eye focuses light on the retina
- 3 2 1 0 18. Describe how the eye and the brain work together to allow a person to see
- 3 2 1 0 19. Explain visual perception, including visual acuity, depth perception, peripheral vision, color vision, and the interpretation of optical illusions
- 3 2 1 0 20. Predict how long the body can function in the absence of water, food or oxygen
- 3 2 1 0 21. List and describe the human body systems that create, process and distribute food, water and oxygen
- 3 2 1 0 22. Deduce the factors, both environmental and personal that can impact the body's ability to survive with limited fuel
- 3 2 1 0 23. Describe the structure and function of the organs in the digestive system
- 3 2 1 0 24. Explain how energy is stored in ATP and how energy is released from ATP
- 3 2 1 0 25. Infer how the calories consumed in daily diet versus the calories expended in daily activities affects overall health
- 3 2 1 0 26. Describe the structure of the respiratory system, especially the lungs, and the basic mechanics of breathing
- 3 2 1 0 27. Illustrates how the structure of the lungs facilitates the exchange of oxygen and carbon dioxide between air and the body
- 3 2 1 0 28. Analyzes the process through which the respiratory and cardiovascular systems facilitates the transport of oxygen to all cells in the body
- 3 2 1 0 29. Describe the structure and function of the human urinary system
- 3 2 1 0 30. Describe how the structure of the kidney relates to its function in the body

- 3 2 1 0 31. Illustrate the composition of normal blood and normal urine
- 3 2 1 0 32. Explain how the body uses hormones to maintain a water balance
- 3 2 1 0 33. Describe how the types of joints found in the human body differ in both structure and function
- 3 2 1 0 34. Demonstrate the meaning of terms that describe the motion at joints, such as flexion and extension
- 3 2 1 0 35. Describe how the three types of muscle tissue differ in structure and function
- 3 2 1 0 36. Describe the requirements for muscle contraction
- 3 2 1 0 37. Illustrate the connection between nerves and muscles
- 3 2 1 0 38. Explain the relationship between the heart and the lungs and trace the path of major circulatory routes
- 3 2 1 0 39. Define pulse and blood pressure and name and locate several pulse points on the body
- 3 2 1 0 40. Identify the body's major arteries and veins and name the body region supplied by each
- 3 2 1 0 41. Describe the ways in which the human body can generate ATP as well as how long the energy will last in each case
- 3 2 1 0 42. Describe the structure and function of human skin
- 3 2 1 0 43. Explain how different degrees of burns damage layers of the skin
- 3 2 1 0 44. Describe how the human body senses and processes signals of pain
- 3 2 1 0 45. Compare the structure and function of compact and spongy bone
- 3 2 1 0 46. Describe the types of bone fractures
- 3 2 1 0 47. Outline what happens to bone structure as we age

- 3 2 1 0 48. Describe the structure and function of the lymphatic and immune system
- 3 2 1 0 49. Describe the interaction between antigens and antibodies
- 3 2 1 0 50. Explain how the systems work together to maintain homeostasis in the body and to complete basic functions such as movement and communication

## 03053 Anatomy & Physiology

**After meeting all state standards for A& P, the following competencies should be covered:**

### Human Structure & Function

- 3 2 1 0 1. Describe the basic structures and functions of cells, tissues, organs, and systems as they relate to homeostasis
- 3 2 1 0 2. Compare relationships among cells, tissue, organs, and systems
- 3 2 1 0 3. Explain body planes, directional terms, quadrants, and cavities
- 3 2 1 0 4. Analyze the interdependence of the body systems as they relate to wellness, disease, therapies, and care rehabilitation

### Disease and Disorders

- 3 2 1 0 5. Compare selected diseases/disorders including respective classification(s), causes, diagnoses, therapies, and care/rehabilitation to include biotechnological applications
- 3 2 1 0 6. Analyze methods to control the spread of pathogenic microorganisms
- 3 2 1 0 7. Analyze body system changes in light of diseases, disorders, and wellness

### Written Communication Skills

- 3 2 1 0 8. Report relevant information in order of occurrence
- 3 2 1 0 9. Distinguish between subjective and objective information and summaries
- 3 2 1 0 10. Recognize, organize, write and compile technical information, data and observations



## Health Care Delivery System

3 2 1 0 11. Identify methods to assess vital signs

## Career Exploration

3 2 1 0 13. Identify a variety of careers that use anatomy and physiology knowledge and how it relates to health careers

## Ethical Practice

3 2 1 0 14. Explain the importance of confidentiality in health care

## Personal Safety

3 2 1 0 15. Use personal protective equipment as appropriate to the environment

## Environmental Safety

3 2 1 0 16. Modify the environment to create safe working conditions. Evaluate and modify the environment to create and maintain safe working conditions

3 2 1 0 17. Prevent accidents by using proper safety techniques for the prevention of accidents

## Health Science Related

3 2 1 0 18. Identify content, skills and technology related to the health science field

3 2 1 0 19. Apply mathematical computations related to common health industry procedures

3 2 1 0 20. Apply mathematical principles to conversion equations commonly used in health related fields

3 2 1 0 21. Apply mathematical principles involving temperature, weights, and measures commonly used in health related fields

3 2 1 0 22. Analyze diagrams, charts, graphs, and tables to interpret results commonly found in health related fields

3 2 1 0 23. Recognize, organize, write and compile technical information and summaries that relate to health science

## 04170 Environmental Law

### General Knowledge

3 2 1 0 1. Explain how the Constitution is used to support and restrain environmental

3 2 1 0 2. Give an example of how occupational and indoor health issues are handled

3 2 1 0 3. Predict how international treaties are used to protect the environment

3 2 1 0 4. Explain how major statutes relevant to marine resource management operate

3 2 1 0 5. Demonstrate the relationship between economics and the environment

3 2 1 0 6. Explain the necessity of Public Resource Management agencies

### Air Pollution Control

3 2 1 0 7. Describe the *Clean Air Act*

3 2 1 0 8. Explain *Clean Air Standards*

3 2 1 0 9. Analyze a major **Air Quality Standards Supreme Court Case** (e.g., *Natural Resources Defense Council v. Train, Lead Industries Inc. v. EPA, Whitman v. American Trucking Assn.*).

### Water Pollution Control

3 2 1 0 10. Explain *Effluent Standards* under the **Clean Water Act**

3 2 1 0 11. Analyze a major **Clean Water Act** court case (e.g., *NRDS v Costle, Sierra Club v. Abston Construction Co., Concerned Area Residents v. Southview Farm*)

### Risk Management and Scientific Uncertainty

3 2 1 0 12. Describe how the EPA assesses risks

3 2 1 0 13. Demonstrate how *Risk Management and Cost-Benefit Analysis* works

3 2 1 0 14. Analyze a court case involving Risk Management (e.g., *Reserve Mining Co. v. EPA, Industrial Union Dept. AFL-CIO v. American Pet Inst., American Textile Manufacturers Inst., Inc. v. Donovan*)

### Regulation of Toxic Substances

3 2 1 0 15. Describe the **Toxic Substances Control Act**

3 2 1 0 16. Explain the *Resource Conservation and Recovery Act*

3 2 1 0 17. Compare and contrast “Solid” and “Hazardous Waste”

3 2 1 0 18. Analyze a Supreme Court case dealing with Toxic Substances (e.g., *Natural Resources Defense Council, Inc., v. EPA, American Mining Congress v. EPA, Chemical Waste Mgt. Inc. v. EPA, Edison Electric Institute v. EPA*)

### Environmental Liability Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund)

3 2 1 0 19. Defend the creation of the U.S. Council on Environmental Quality

3 2 1 0 20. Analyze a Supreme Court Case dealing with **CERCLA** (e.g., *U.S. v. Monsanto Co., U.S. v. Northeastern Pharmaceutical and Chemical Co., U.S. v. Cannons Engineering Corp.*)

### National Environmental Policy Act

3 2 1 0 21. Summarize the requirements of the *National Environmental Policy Act (NEPA)*

3 2 1 0 22. Analyze a Supreme Court Case involving the NEPA (e.g., *Hanly v. Mitchell, Hanly v. Kleidienst, Kieppe v. Sierra Club, Marsh v. Oregon Natural Resources Council, Robertson v. Methow Valley Citizens Council*)

### Endangered Species Act

3 2 1 0 23. Outline the rationale for preserving Bio Diversity

3 2 1 0 24. Discuss the sections of the **Endangered Species Act**

3 2 1 0 25. Analyze the impact of one Supreme Court Case involving the **ESA** (e.g., *Tennessee Valley Authority v. Hill, Robertson v. Seattle Audubon Society, Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, Thomas v. Petersen*)

### Developing Private Lands and Coastal Waters

3 2 1 0 26. Distinguish between public and private rights in the coastal zone

3 2 1 0 27. Describe the right of public access to Beaches and shores

- 3 2 1 0 28. Paraphrases the Coastal Zone Management Act
- 3 2 1 0 29. Analyzes the Tidelands Controversy and the Submerged Lands Act

## 18308 Biotechnology in Agriculture

### Biotechnology in Agriculture

- 3 2 1 0 1. Define biotechnology and explore the historical impact it has had on agriculture
- 3 2 1 0 2. Investigate current applications of biotechnology in agriculture.
- 3 2 1 0 3. Examine potential future applications of biotechnology in agriculture and compare them with alternative approaches to improving agriculture

### Regulatory Issues & Agencies

- 3 2 1 0 1. Describe the role of agencies that regulate biotechnology

### Ethical, Legal, Social & Cultural Issues

- 3 2 1 0 1. Explore ethical, legal and social biotechnology related issues
- 3 2 1 0 2. Explore the emergence, evolution and implications of bioethics
- 3 2 1 0 3. Explain the meaning of intellectual properties as related to biotechnology

### Biotechnology Laboratory Records

- 3 2 1 0 1. Maintain a biotechnology laboratory notebook

### Operate Laboratory Equipment

- 3 2 1 0 1. Operate basic laboratory equipment and measurement devices

### Procedure Using Biological Materials

- 3 2 1 0 1. Demonstrate basic aseptic techniques in the biotechnology laboratory
- 3 2 1 0 2. Perform procedures with biological materials according to directions

### Safely Manage Biological Materials

- 3 2 1 0 1. Prepare simple chemical solutions using standard operating procedures
- 3 2 1 0 2. Identify and describe hazards associated with biological and chemical materials
- 3 2 1 0 3. Maintain a safe environment by properly identifying and disposing of laboratory waste

### Perform a Variety of Procedures

- 3 2 1 0 1. Differentiate the types of organisms and demonstrate how to handle them safely
- 3 2 1 0 2. Explain the structures of DNA and RNA and how genotype influences phenotype
- 3 2 1 0 3. Extract and purify DNA and RNA
- 3 2 1 0 4. Perform simple enzyme activity assays to detect proteins
- 3 2 1 0 5. Describe how antibodies are formed and how they can be used in biotechnology applications
- 3 2 1 0 6. Explain reasons for detecting microbes and identify sources of microbes

### Genetic Engineering Improve Products

- 3 2 1 0 1. Explain biological, social, agronomic and economic reasons for genetic modification of eukaryotes
- 3 2 1 0 2. Describe enzymes, the changes they cause in foods and the physical and chemical parameters that affect enzymatic reactions
- 3 2 1 0 3. Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes
- 3 2 1 0 4. Describe the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of aquatic species

### Perform Biotechnology Processes

- 3 2 1 0 1. Explain the functions of hormones in animals
- 3 2 1 0 2. Identify foods produced through fermentation
- 3 2 1 0 3. Explain the process of fermentation

- 3 2 1 0 4. Explain the process of transesterification

- 3 2 1 0 5. Explain the process of methanogenesis

### Monitor & Evaluate Procedures

- 3 2 1 0 1. Describe the selective plant breeding process
- 3 2 1 0 2. Describe biotechnology processes applicable to animal health
- 3 2 1 0 3. Give examples of instances in which bioremediation can be applied to clean up environmental contaminants
- 3 2 1 0 4. Explain the use of microorganisms in biological waste management
- 3 2 1 0 5. Explain the role of microorganisms in industrial chemical waste treatment
- 3 2 1 0 6. Explain the global importance of biodiversity
- 3 2 1 0 7. Explain the consequences of agricultural practices on wild populations
- 3 2 1 0 8. Explain biomass and sources of biomass
- 3 2 1 0 9. Define industrial biotechnology, and describe the benefits and risks associated with its use in the manufacturing of fabrics, plastics and other products

## 03207 AP Environmental Science

### Earth Systems and Resources

- 3 2 1 0 1. Explain the concept of geologic time scale.
- 3 2 1 0 2. Outline the connections between plate tectonics, earthquakes and volcanism.
- 3 2 1 0 3. Illustrate the layers of the earth's atmosphere.
- 3 2 1 0 4. Explain the concept of the atmospheric circulation and the Coriolis Effect.
- 3 2 1 0 5. Explain the concept of ocean circulation.
- 3 2 1 0 6. Outline surface and groundwater issues.
- 3 2 1 0 7. Explain the rock cycle.

3 2 1 0 8. Describe the main soil types.

3 2 1 0 9. Recall the rock formation process.

### **The Living World**

3 2 1 0 10. Explain the concept of ecological niches.

3 2 1 0 11. Label on a map the locations of the major terrestrial and aquatic biomes.

3 2 1 0 12. Define the concept of keystone species.

3 2 1 0 13. Diagram the processes of photosynthesis and cellular respiration.

3 2 1 0 14. Analyze the relationship between food webs and trophic levels.

3 2 1 0 15. Interprets the concepts of Biodiversity, natural selection and evolution.

3 2 1 0 16. Describes climate shifts, species movement and ecological succession.

3 2 1 0 17. Illustrates a natural biogeochemical cycle (e.g. Carbon, nitrogen, phosphorous, sulfur, water)

### **Population**

3 2 1 0 1. Explain the concept of carrying capacity

3 2 1 0 2. Interpret human fertility rates, growth rates and doubling times

3 2 1 0 3. Infers strategies for sustainability

3 2 1 0 4. Predicts the impact of population growth on a region or bio-system

### **Land and Water Use**

3 2 1 0 22. Describes human nutritional requirements

3 2 1 0 23. Predict the impact of genetic engineering on crop production.

3 2 1 0 24. Generate ideas about the future of sustainable agriculture

3 2 1 0 25. Compare old growth forests with new growth.

3 2 1 0 26. Explain forest management.

3 2 1 0 27. Explain the dangers of overgrazing of rangeland

3 2 1 0 28. Outline the concerns with urban land development (e.g., planned development, suburban sprawl, urbanization)

3 2 1 0 29. Describe the problems associated with overfishing

### **Energy Resources and Consumption**

3 2 1 0 30. Explain major concepts associated with Energy (i.e., energy forms, units, conversions, Laws of Thermodynamics)

3 2 1 0 31. Summarizes present global energy use.

3 2 1 0 32. Illustrates the processes involved in the formation of coal, oil and natural gas

3 2 1 0 33. Explain the process of nuclear fission.

3 2 1 0 34. Investigate the environmental advantages/disadvantages of nuclear energy

3 2 1 0 35. Summarizes the process of obtaining hydroelectric power.

3 2 1 0 36. Compares various types of energy conservation strategies.

3 2 1 0 37. Critiques various types of renewable energy (i.e., solar energy, hydrogen fuel cells, wind energy, ocean waves and tidal energy, geothermal)

### **Pollution**

3 2 1 0 38. Identifies the primary and secondary sources of air pollution.

3 2 1 0 39. Lists the primary sources of noise pollution.

3 2 1 0 40. Recalls the major sources of water pollution

3 2 1 0 41. Summarizes major laws addressing water and air pollution (i.e., Clean Water Act, Clean Air Act)

3 2 1 0 1. Explains the process of environmental risk analysis

3 2 1 0 1. Discovers what hazardous chemicals are most common in the environment

3 2 1 0 44. Evaluates the economic impact of pollution on society through a cost-benefit analysis activity

### **Global Change**

3 2 1 0 1. Explain the process of stratospheric ozone formation

3 2 1 0 1. Describe the impacts and consequences of global warming

3 2 1 0 1. Explain the impact of habitat loss on biodiversity

3 2 1 0 1. Summarize the reasons for endangered and threatened species legislation

## **03203 APPLIED BIOCHEMISTRY**

3 2 1 0 1. Study the chemistry of living processes, such as cell development, respiration and digestion, and living energy changes such as growth, aging, and death.

3 2 1 0 2. Study physical principles of living cells and organisms and their electrical and mechanical energy, applying methods and knowledge of mathematics, physics, chemistry, and biology.

3 2 1 0 3. Isolate, analyze, and/or synthesize vitamins, hormones, allergens, minerals, and enzymes, and determine their effects on cell functions.

3 2 1 0 4. Examine the molecular and chemical aspects of immune system functioning.

3 2 1 0 5. Research how characteristics of organisms are carried through successive generations.

3 2 1 0 6. Research the chemical effects of substances such as drugs, serums, hormones, and food on tissues and vital processes.

3 2 1 0 7. Investigate the nature, composition, and expression of genes, and research how genetic engineering can impact these processes.

3 2 1 0 8. Read current scientific and trade literature to stay abreast of scientific, industrial, or technological advances.

3 2 1 0 9. Design or conduct studies to determine optimal conditions for cell growth, protein production, or protein and virus expression and recovery.

- 3 2 1 0 10. Communicate research results through presentations or project reports.
- 3 2 1 0 11. Analyze clinical or survey data using statistical approaches such as longitudinal analysis, mixed effect modeling, logistic regression analyses, and model building techniques.
- 3 2 1 0 12. Analyze archival data such as birth, death, and disease records.
- 3 2 1 0 13. Draw conclusions and make predictions based on data summaries or statistical analyses.
- 3 2 1 0 14. Maintain laboratory notebooks that record research methods, procedures, and results.

## 14253 PHARMACOLOGY

- 3 2 1 0 1. Cite historical perspectives contributing to the development of pharmacology through the present.
- 3 2 1 0 2. Utilize the nursing process and the five concepts of human functioning to assess appropriate/inappropriate responses to therapy
- 3 2 1 0 3. Identify the roles of the professional nurse in relation to medication administration and education in both acute care and community health settings
- 3 2 1 0 4. Explain the correct measures to ensure the prevention of medication errors. Evaluate example measures taken to determine if they ensure the prevention of medication errors
- 3 2 1 0 5. Employ critical thinking skills to determine the effectiveness of medication administration on client care outcomes

- 3 2 1 0 6. Predict potential drug-drug interactions and drug-food interactions based on physiological responses to pharmacological agents and apply critical thinking skills for appropriate intervention
- 3 2 1 0 7. Recognize differences in physiology and pathophysiology that must be considered in assessing correct dosages administered to “at risk” populations such as the fetus, infant, child, pregnant woman, and the frail elderly
- 3 2 1 0 8. Use the legal and ethical principles related to research and practice of medication administration in nursing to evaluate best practice in real-world scenarios
- 3 2 1 0 9. Relate the differences in pharmaceutical? use and its effects across the lifespan, when administering medications to culturally diverse populations for commonly occurring diseases
- 3 2 1 0 10. Define the pharmacological terminology pertinent to specific categories and classifications of medications in relation to drug effects on commonly occurring diseases
- 3 2 1 0 11. Identify major classifications of drug therapies/functions by prototypes as used in the treatment of commonly occurring health challenges
- 3 2 1 0 12. Interpret effective communication in reports of the action, rationale for use, common and/or life- threatening side effects, nursing implications, and client teaching issues for each major classification of medications
- 3 2 1 0 13. Describe basic principles of pharmacology including sources of drugs, divisions of pharmacology, differences between the chemical, generic and brand name of drugs
- 3 2 1 0 14. State the functions of various regulatory agencies and legislative acts that regulate drug use

- 3 2 1 0 15. Describe the function of each of the various publications that catalog drugs.
- 3 2 1 0 16. Describe the classical and practical parts of a prescription
- 3 2 1 0 17. Identify the common Latin abbreviations used in prescription writing
- 3 2 1 0 18. Describe the proper handling of prescriptions and drugs including a basic "safe" policy for storage of medications
- 3 2 1 0 19. Describe the routes of administration of drugs including advantages and disadvantages of each
- 3 2 1 0 20. Describe the effects of drugs
- 3 2 1 0 21. Identify the function of both mild and strong analgesics, and describe their actions
- 3 2 1 0 22. Identify the function of local anesthetics, types, and use of vasoconstrictors
- 3 2 1 0 23. Identify sedative/hypnotics, and describe their actions
- 3 2 1 0 24. Identify antianxiety drugs, and describe their actions
- 3 2 1 0 25. Identify classifications of antibiotic drugs: penicillin's, erythromycins, tetracycline's, cephalosporin's, and sulfonamides
- 3 2 1 0 26. Identify hypotensive drugs, anticoagulant drugs, drugs used for cardiovascular disease, diabetic drugs, hypothyroid drugs, corticosteroids; and describe their uses
- 3 2 1 0 27. Identify and describe the uses of antihistamine drugs, bronchial dilators, anticonvulsants, ant sialogogues, and local hemostatic

## 18055 PLANT SCIENCE

### History and Careers in Plant Science

- 3 2 1 0 1. Investigate the diversity of careers in plant science
- 3 2 1 0 2. Attend job or career fields
- 3 2 1 0 3. Contact plant science professional organizations
- 3 2 1 0 4. Job shadow a professional in the plant industry
- 3 2 1 0 5. Create a timeline of the history of plant science, relating the past, present and future

### Supervised Agriculture Experience (SAE) & Record Keeping

- 3 2 1 0 1. Identify and maintain the SAE (C)
- 3 2 1 0 2. Construct a personal budget (M)
- 3 2 1 0 3. Utilize the Kansas FFA SAE Record book to monitor the SAE (C)
- 3 2 1 0 4. Complete a local and district proficiency award applications (E)
- 3 2 1 0 5. Complete chapter and/or State FFA Degree applications (E)
- 3 2 1 0 6. Use Quicken to track income and expense in cash, checking, and savings (C)
- 3 2 1 0 7. Track SAE skills developed, hours worked as well as FFA, school, and community activities using the Ag Ed record book (C)
- 3 2 1 0 8. Set appropriate SAE long and short term goals (E)

### Lab Activities (L)

- 3 2 1 0 1. Prepare income and expense records (C, M)
- 3 2 1 0 2. Prepare monthly cash flow statements (C, M)
- 3 2 1 0 3. Record personal and business inventories, assets, and liabilities (C, M)

### The National FFA Organization and Leadership

- 3 2 1 0 1. Participate in Student Development activities established by the local POA established by the local POA

- 3 2 1 0 2. Participate in Chapter Development activities
- 3 2 1 0 3. Participate in Community Development activities established by the local POA
- 3 2 1 0 4. Research a 3-8 minute speech on an agricultural topic (E)
- 3 2 1 0 5. Write a final manuscript for a 3-8 minute speech over an agriculture topic using MLA style with title page and works cited (C, E)
- 3 2 1 0 6. Present a memorized 3-8 minute agriculture speech to the class (C, E)
- 3 2 1 0 7. Participate in the Agronomy Career Development Event (C)

### Basic soil properties and fertility

- 3 2 1 0 1. Define soil texture and structure
- 3 2 1 0 2. Use the textural triangle to identify classification
- 3 2 1 0 3. Describe water holding capacity, available water, and wilting points, permeability, leaching are effected by soil texture and nutrient availability
- 3 2 1 0 4. Perform and Interpret soil test data and give objective recommendations
- 3 2 1 0 5. Describe how mass flow, diffusion, and root interception affect nutrient uptake
- 3 2 1 0 6. Illustrate the N-cycle and how climate, soil, and plants effect it
- 3 2 1 0 7. Describe and distinguish between the different soil management practices in Ag
- 3 2 1 0 8. Describe how pH affects soil health and nutrient availability
- 3 2 1 0 9. Distinguish between point and non-point sources in the environment
- 3 2 1 0 10. Illustrate the water cycle and how climate, soil, and plants effect it
- 3 2 1 0 11. List and differentiate between micro and macro soil nutrients (S)
- 3 2 1 0 12. Outline the impact of soils on crop yields (S)

- 3 2 1 0 13. Identify various types of parent material types and soil forming factors
- 3 2 1 0 14. Describe methods of building soil fertility (S)
- 3 2 1 0 15. Explain considerations for determining N, P, and K for soil fertility and plant growth
- 3 2 1 0 16. Formulate the proper mix of dry fertilizer (M)

### Plant Structures/Systems

- 3 2 1 0 1. Explain the process of translocation
- 3 2 1 0 2. Identify and describe the function of plant cell (S)
- 3 2 1 0 3. Identify the parts of monocot and dicot seeds and list their functions (S)
- 3 2 1 0 4. Distinguish between GMO and PLS plants and seeds
- 3 2 1 0 5. Describe methods of plant classification/nomenclature and the action of variation in natural selection(S)
- 3 2 1 0 6. Define how evapo-transpirations relates to plant growth
- 3 2 1 0 7. Define photoperiodism (S)
- 3 2 1 0 8. Explain the processes of photosynthesis, respiration, and transpiration as a cyclical growth representation (S, E)
- 3 2 1 0 11. Illustrate the sink/source of the complete carbon cycle
- 3 2 1 0 12. Illustrate the sink/source of the complete oxygen cycle
- 3 2 1 0 13. Discuss the means and effects of pollination
- 3 2 1 0 14. Relate the growing degree day concept to crop development
- 3 2 1 0 15. Understand how temperature is important in plant development and growth (cardinal temperatures)

### Weed, Disease, and Pest Control

- 3 2 1 0 1. Identify weed, disease, and pest damage (S)
- 3 2 1 0 2. Show disease material handling techniques (S)



- 3 2 1 0 3. Identify safe procedures when handling pesticides
- 3 2 1 0 4. Calculate pesticide application rates (M)
- 3 2 1 0 5. Identify the components of a pesticide label
- 3 2 1 0 6. Demonstrate how to mix pesticides (S)
- 3 2 1 0 7. Describe the general principles of IPM
- 3 2 1 0 8. Distinguish between resistance and tolerance
- 3 2 1 0 9. Recognize the differences in pesticide formulation from climatic conditions, using additives for drift or volatilization
- 3 2 1 0 10. Identify weeds from broadleaf and grass seedlings
- 3 2 1 0 11. Relate how weed life cycles differ from crop life cycles
- 3 2 1 0 12. Recognize the role of natural selection in disease, weed, and pest control in a cropping practice
- 3 2 1 0 13. Determine the best control measure for a given pest
- 3 2 1 0 14. Relate how insect behavior is linked with a cropping practice
- 3 2 1 0 15. Generate a list of beneficial insects and plants that counteract harmful weeds, diseases, and pests
- 3 2 1 0 16. Describe strategies needed for disease management
- 3 2 1 0 17. Explain the use of pesticides as a pest management strategy
- 3 2 1 0 18. Explain how stewardship, pesticide safety, and government regulation impact common cropping decisions
- 3 2 1 0 19. Understand how factors of pressure, speed, nozzle type, and spacing affect pesticide treatment success
- 3 2 1 0 20. Describe the effects of herbicide: adjuvants, contact, systemic

### Lab Activities (L)

- 3 2 1 0 1. Locate PPE, REI, and Mixing instructions on a pesticide

### Genetics

- 3 2 1 0 1. Define the terms in their relationship with plant science and agriculture: hybrid, heterosis, homozygous, heterozygous, genotype, and phenotype (S)
- 3 2 1 0 2. Use and analyze a Punnet square (S)
- 3 2 1 0 3. Specify how the principles of genetics are used in plant and animal breeding programs (S)
- 3 2 1 0 4. Explain how hybrid plant varieties are developed (S)
- 3 2 1 0 5. Differentiate between dominant and recessive genes (S)
- 3 2 1 0 6. List examples of genetically engineered products (S)
- 3 2 1 0 7. Summarize laws and environmental/social concerns associated with genetic engineering (S)

### Lab Activities (L)

- 3 2 1 0 1. Monitor phenotypes in a plant breeding program (S)
- 3 2 1 0 2. Research genetic engineering (S)

### Fertilizer Applications

- 3 2 1 0 1. List characteristics of solid, gas, and liquid fertilizers
- 3 2 1 0 2. Understand the effects of starter fertilizer on crop growth and yield
- 3 2 1 0 3. Distinguish how fertilizer placement and time of application affect nutrient availability

### Crop Evaluation

- 3 2 1 0 1. Properly classify common crops and weeds
- 3 2 1 0 2. Describe standards used in USDA grain grading
- 3 2 1 0 3. Identify principles of irrigated water vs. dry land in crop growth, seed formation, and quality

### Lab Activities (L)

- 3 2 1 0 1. Identify noxious weeds and their seeds

- 3 2 1 0 2. Identify restrictive weeds and their seeds
- 3 2 1 0 3. Identify common weeds and their seeds
- 3 2 1 0 4. Identify forage crops and their seeds
- 3 2 1 0 5. Identify grain crops and their seeds
- 3 2 1 0 6. Perform USDA Grain Grading (M)
- 3 2 1 0 7. Perform seed analysis

### Biotechnology Issues

- 3 2 1 0 1. Access and review material from biotechnology firms; i.e. Monsanto, Pioneer, etc.
- 3 2 1 0 2. Discuss the most recent advances; i.e. Bt Corn, Round-Up Ready crops
- 3 2 1 0 3. Discuss moral issues in biotechnology and gene tampering
- 3 2 1 0 4. Discuss the role of biotechnology to improve plant genetics and production

### Crop Storage

- 3 2 1 0 1. Describe how temperature, aeration, pests, crop condition at harvest, length of storage, and additives influence crop quality
- 3 2 1 0 2. Discuss the difference between retained ownership and storage under warehouse receipt
- 3 2 1 0 3. Calculate volume of bins and storage areas
- 3 2 1 0 4. Calculate relative humidity, dew point, wet/dry bulb temperature, and saturation point
- 3 2 1 0 5. Calculate moisture content, drying efficiency, and gas consumption for drying high moisture corn.

### Mathematics Career Development Skills (C)

- 3 2 1 0 1. Estimate, apply, and solve problems involving fractions, decimals, and percentages (M)
- 3 2 1 0 2. Translate written and verbal statements into math expressions (M)
- 3 2 1 0 3. Convert common units of measurement within and/or across measurement systems (M)



- 3 2 1 0 4. Apply concepts of measurement such as distance, direction, rate, and time (M)
- 3 2 1 0 5. Construct or interpret tables, charts, maps, and/or graphs (M)
- 3 2 1 0 6. Decide whether a problem is best solved with a computer, calculator, paper, and pencil, or mental arithmetic techniques (M)

#### **Communications Career Development Skills (C)**

- 3 2 1 0 1. Follow oral instructions (E)
- 3 2 1 0 2. Participate in group communication activities (E)
- 3 2 1 0 3. Give oral directions (E)
- 3 2 1 0 4. Use language and format appropriate to the subject matter, purpose, and audience (E)

#### **Other Career Development Skills (C)**

- 3 2 1 0 1. Set priorities that several tasks will be accomplished (C)
- 3 2 1 0 2. Utilize time management to reduce conflicts (C)
- 3 2 1 0 3. Apply rules including punctuality, attendance, and work ethic (C)
- 3 2 1 0 4. Access and use information to develop educational and career options (C)
- 3 2 1 0 5. Demonstrate stress management skills (C)

#### **Computer Literacy (C)**

- 3 2 1 0 1. Define, understand, and use common computer technology terms (C)
- 3 2 1 0 2. Compose, organize, and edit information using a computer (C)
- 3 2 1 0 3. Use presentation software to design and create a presentation (C)
- 3 2 1 0 4. Use agricultural related software/websites (C)
- 3 2 1 0 5. Access, navigate, and use on-line services (C)
- 3 2 1 0 6. Send and receive email messages with enclosures (C)
- 3 2 1 0 7. Use Quicken to manage personal finance (C)

- 3 2 1 0 8. Use Microsoft Office (Word, Excel, Powerpoint, and Internet Explorer) to complete projects (C)

#### **LifeKnowledge Lessons**

- 3 2 1 0 1. My decisions and the opinions of others (HS 20)
- 3 2 1 0 2. Critical thinking skills (HS 24)
- 3 2 1 0 3. The value of diversity on teams (HS 70)
- 3 2 1 0 4. Human potential (HS 100)

## **18058 PLANT & SOIL SCIENCE**

#### **History and Careers in Plant Science**

- 3 2 1 0 1. Investigate the diversity of careers in plant science
- 3 2 1 0 2. Attend job or career fields
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- 3 2 1 0 5. Create a timeline of the history of plant science, relating the past, present and future

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- 3 2 1 0 3. Describe water holding capacity, available water, and wilting points, permeability, leaching are effected by soil texture and nutrient availability(S)
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- 3 2 1 0 13. Discuss the means and effects of pollination(S)

- 3 2 1 0 14. Relate the growing degree day concept to crop development
- 3 2 1 0 15. Understand how temperature is important in plant development and growth (cardinal temperatures)(S)

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- 3 2 1 0 3. Identify safe procedures when handling pesticides
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- 3 2 1 0 15. Generate a list of beneficial insects and plants that counteract harmful weeds, diseases, and pests
- 3 2 1 0 16. Describe strategies needed for disease management
- 3 2 1 0 17. Explain the use of pesticides as a pest management strategy(EB)
- 3 2 1 0 18. Explain how stewardship, pesticide safety, and government regulation impact common cropping decisions

- 3 2 1 0 19. Understand how factors of pressure, speed, nozzle type, and spacing affect pesticide treatment success
- 3 2 1 0 20. Describe the effects of herbicide: adjuvants, contact, systemic(S)

#### **Lab Activities (L)**

- 3 2 1 0 1. Locate PPE, REI, and Mixing instructions on a pesticide

#### **Genetics**

- 3 2 1 0 1. Define the terms in their relationship with plant science and agriculture: hybrid, heterosis, homozygous, heterozygous, genotype, and phenotype (S)
- 3 2 1 0 2. Use and analyze a Punnet square (S)
- 3 2 1 0 3. Specify how the principles of genetics are used in plant and animal breeding programs (S)
- 3 2 1 0 4. Explain how hybrid plant varieties are developed (S)
- 3 2 1 0 5. Differentiate between dominant and recessive genes (S)
- 3 2 1 0 6. List examples of genetically engineered products (S)
- 3 2 1 0 7. Summarize laws and environmental/social concerns associated with genetic engineering (S)

#### **Lab Activities (L)**

- 3 2 1 0 1. Monitor phenotypes in a plant breeding program (S)
- 3 2 1 0 2. Research genetic engineering (S)

#### **Fertilizer Applications**

- 3 2 1 0 1. List characteristics of solid, gas, and liquid fertilizers
- 3 2 1 0 2. Understand the effects of starter fertilizer on crop growth and yield
- 3 2 1 0 3. Distinguish how fertilizer placement and time of application affect nutrient availability

#### **Crop Evaluation**

- 3 2 1 0 1. Properly classify common crops and weeds
- 3 2 1 0 2. Describe standards used in USDA grain grading

3 2 1 0 3. Identify principles of irrigated water vs. dry land in crop growth, seed formation, and quality

#### **Lab Activities (L)(EB)**

- 3 2 1 0 1. Identify noxious weeds and their seeds
- 3 2 1 0 2. Identify restrictive weeds and their seeds
- 3 2 1 0 3. Identify common weeds and their seeds
- 3 2 1 0 4. Identify forage crops and their seeds
- 3 2 1 0 5. Identify grain crops and their seeds
- 3 2 1 0 6. Perform USDA Grain Grading (M)
- 3 2 1 0 7. Perform seed analysis

#### **Biotechnology Issues**

- 3 2 1 0 1. Access and review material from biotechnology firms; i.e. Monsanto, Pioneer, etc.
- 3 2 1 0 2. Discuss the most recent advances; i.e. Bt Corn, Round-Up Ready crops
- 3 2 1 0 3. Discuss moral issues in biotechnology and gene tampering
- 3 2 1 0 4. Discuss the role of biotechnology to improve plant genetics and production

#### **Crop Storage**

- 3 2 1 0 1. Describe how temperature, aeration, pests, crop condition at harvest, length of storage, and additives influence crop quality
- 3 2 1 0 2. Discuss the difference between retained ownership and storage under warehouse receipt

- 3 2 1 0 3. Calculate volume of bins and storage areas(M)
- 3 2 1 0 4. Calculate relative humidity, dew point, wet/dry bulb temperature, and saturation point (M)(S)
- 3 2 1 0 5. Calculate moisture content, drying efficiency, and gas consumption for drying high moisture corn.(M)(S)

#### **Mathematics Career Development Skills (C)**

- 3 2 1 0 1. Estimate, apply, and solve problems involving fractions, decimals, and percentages (M)

- 3 2 1 0 2. Translate written and verbal statements into math expressions (M)
- 3 2 1 0 3. Convert common units of measurement within and/or across measurement systems (M)
- 3 2 1 0 4. Apply concepts of measurement such as distance, direction, rate, and time (M)
- 3 2 1 0 5. Construct or interpret tables, charts, maps, and/or graphs (M)
- 3 2 1 0 6. Decide whether a problem is best solved with a computer, calculator, paper, and pencil, or mental arithmetic techniques (M)

#### **Communications Career Development Skills (C)**

- 3 2 1 0 1. Follow oral instructions (E)
- 3 2 1 0 2. Participate in group communication activities (E)
- 3 2 1 0 3. Give oral directions (E)

- 3 2 1 0 4. Use language and format appropriate to the subject matter, purpose, and audience (E)

#### **Other Career Development Skills (C)**

- 3 2 1 0 1. Set priorities that several tasks will be accomplished (C)
- 3 2 1 0 2. Utilize time management to reduce conflicts (C)
- 3 2 1 0 3. Apply rules including punctuality, attendance, and work ethic (C)
- 3 2 1 0 4. Access and use information to develop educational and career options (C)
- 3 2 1 0 5. Demonstrate stress management skills (C)

#### **Computer Literacy (C)**

- 3 2 1 0 1. Define, understand, and use common computer technology terms (C)
- 3 2 1 0 2. Compose, organize, and edit information using a computer (C)
- 3 2 1 0 3. Use presentation software to design and create a presentation (C)
- 3 2 1 0 4. Use agricultural related software/websites (C)
- 3 2 1 0 5. Access, navigate, and use on-line services (C)
- 3 2 1 0 6. Send and receive email messages with enclosures (C)
- 3 2 1 0 7. Use Quicken to manage personal finance (C)
- 3 2 1 0 8. Use Microsoft Office (Word, Excel, Powerpoint, and Internet Explorer) to complete projects (C)

#### **Life Knowledge Lessons(EB)**

- 3 2 1 0 1. My decisions and the opinions of others (HS 20)
- 3 2 1 0 2. Critical thinking skills (HS 24)
- 3 2 1 0 3. The value of diversity on teams (HS 70)
- 3 2 1 0 4. Human potential (HS 100)

## APPLICATION LEVEL COURSES

### 21053 EMERGING TECHNOLOGIES IN STEM

- 3 2 1 0 1. Demonstrate the research skills necessary to identify and evaluate emerging technologies
- 3 2 1 0 2. Seek and identify sources of information on new technology
- 3 2 1 0 3. Identify solutions and problems that go beyond the expected and obvious
- 3 2 1 0 4. Identify sciences and technology areas most impacted and with most potential to utilize the new technologies
- 3 2 1 0 5. Be able to explain why it is important for STEM professionals to keep abreast of evolving technologies.
- 3 2 1 0 6. Be able to discuss the advantages, disadvantages, and prospects of current emerging technologies.
- 3 2 1 0 7. Discuss in depth a chosen emerging technology, based on independent research.
- 3 2 1 0 8. Explain the change process.
- 3 2 1 0 9. Develop a plan for anticipating change.
  - a. anticipated employment,
  - b. drivers and constraints,
  - c. size and location of market,
  - d. connection(s) to existing technologies,
  - e. ability and ease of replication,
  - f. physical and capital costs,
  - g. industry and education partnerships to be leveraged,
  - h. national best practices,

- i. illustrate qualifications, and recommendations, aims and approaches for the Technological innovation
- j. Innovation system modeling
- k. Technology monitoring, forecasting and assessment
- l. Trend analysis methods & scenarios
- m. Impact assessment
- n. Risk analysis
- o. Action (policy) analysis
- p. Technology road mapping
- q. Communication and implementation of innovation forecasts

### 21020/21014 BioEngineering or Biotechnical Engineering

#### Biotechnical Engineering Procedures

- 3 2 1 0 1. Summarize the components of effective communication.
- 3 2 1 0 2. List the forms of documentation needed for effective communication.
- 3 2 1 0 3. Outline the steps necessary to keep one's self safe in a laboratory setting.
- 3 2 1 0 4. Relates what could happen to experiment results if measurement is performed or recorded incorrectly.
- 3 2 1 0 5. Distinguishes the difference between accuracy and precision
- 3 2 1 0 6. Explains how both accuracy and precision play a vital role in the design process

#### Biotechnical Engineering History and Industry

- 3 2 1 0 7. Outline the evolution of biotechnical engineering.

- 3 2 1 0 8. Illustrate the major biotechnical engineering milestones using a wide variety of internet resources.
- 3 2 1 0 9. Assess the impact of each milestone based on their research.
- 3 2 1 0 10. Identify the fundamental concepts common to all major industries in biotechnical engineering.
- 3 2 1 0 11. Identify and explain how biotechnical engineered products impact society.
- 3 2 1 0 12. Predict future developments in biotechnical engineering.
- 3 2 1 0 13. Investigate the relationship between financial markets and scientific research

#### Values and Ethics

- 3 2 1 0 14. Distinguish between values and morals.
- 3 2 1 0 15. Identify some of the parameters that shape an individual's ethics.
- 3 2 1 0 16. Discuss bioethics.
- 3 2 1 0 17. Explain why it is important to consider the bioethical issues of technological advancements.
- 3 2 1 0 18. Outline the steps that might be used in determining the societal and environmental ramifications of biotechnology research.
- 3 2 1 0 19. Explain why it is important to keep an open mind to different perspectives in biotechnical research

#### Bioinformatics

- 3 2 1 0 20. Summarize the molecular techniques that are used by bioinformaticists.
- 3 2 1 0 21. Create a portfolio demonstrating the research and integration of forensics with engineering.

- 3 2 1 0 22. Illustrate the process necessary for creating a fuming chamber for lifting prints from evidence.
- 3 2 1 0 23. Analyze the technology utilized in the field of forensics.
- 3 2 1 0 24. Apply knowledge of genetic engineering to the design of a novel and beneficial application of the reporter gene, green fluorescent protein.
- 3 2 1 0 25. Describe how to isolate proteins.

#### **Fermentation**

- 3 2 1 0 26. Describe the applications of fermentation in food production and renewable energy.
- 3 2 1 0 27. Design a method or instrumentation to be used for measuring rates of fermentation.
- 3 2 1 0 28. Explain what variables affect CO<sub>2</sub> production in yeast in order to determine the ideal conditions for fermentation.

#### **Biomedical Engineering**

- 3 2 1 0 29. Demonstrate the application of engineering principles by improving upon existing hospital designs or surgical equipment designs.
- 3 2 1 0 30. Explain the concepts of product liability, product reliability, product reusability and product failure.

#### **Orthopedics**

- 3 2 1 0 31. Identify anatomical joint features and movements.
- 3 2 1 0 32. Design a joint model with the same degrees of freedom as the human counterpart.
- 3 2 1 0 33. Synthesize skeletal system concepts with the design process for engineering joints.

#### **Cardiovascular Devices and Imaging**

- 3 2 1 0 34. Summarize the most common forms of heart disease and disorders..
- 3 2 1 0 35. Explain procedures involving artificial heart surgery.
- 3 2 1 0 36. Estimate the cost of a proposed noninvasive implant.
- 3 2 1 0 37. Design a portable ECG monitor and study the electrical aspects associated with the heart.

## **18504 NATURAL RESOURCES MANAGEMENT**

#### **Our Natural Resources**

- 3 2 1 0 1. Describe the environment and how human activity causes change (S, SS, LA)
- 3 2 1 0 2. Explain natural resources, and list examples (S, LA)
- 3 2 1 0 3. Contrast and compare renewable and nonrenewable natural resources (S, LA)
- 3 2 1 0 4. List natural resources found in Kansas (S)

#### **Sustaining the Environment**

- 3 2 1 0 5. Describe the importance of sustainability
- 3 2 1 0 6. Appraise the need for biodiversity (S)
- 3 2 1 0 7. Explain the basic life needs that the environment provides (S, LA)
- 3 2 1 0 8. Identify three roles of humans in the environment (LK MS 18)

#### **Resource Conservation**

- 3 2 1 0 9. Contrast and compare conservation and preservation (LA)
- 3 2 1 0 10. Identify ways humans affect resources

#### **Human Population Growth and demand**

- 3 2 1 0 11. Describe world population changes and trends and interpret graphs and maps (SS, LA)
- 3 2 1 0 12. Create a timeline on how population changes occur (E, SS)
- 3 2 1 0 13. Identify and explain three major problems associated with overpopulation (SS, LA)

#### **Biology and the Environment**

- 3 2 1 0 14. Utilize the taxonomy of living things (S)
- 3 2 1 0 15. Classify organisms by their role in the environment (S)

#### **Organisms and the Environment**

- 3 2 1 0 16. Construct a life span of two different types of animals (S,E)
- 3 2 1 0 17. Describe the life processes essential for life (S, LA)
- 3 2 1 0 18. Compare and contrast the structure of living organisms (S, LA)
- 3 2 1 0 19. Relate heredity, genetics, and biodiversity to the environment (S)

#### **Earth Science and the Environment**

- 3 2 1 0 20. Identify the six areas of earth science (S)

#### **Applying Ecology**

- 3 2 1 0 21. Define ecology and ecosystems (S, LA)
- 3 2 1 0 22. Describe natural selection, adaptation and succession (S, LA)
- 3 2 1 0 23. Define population attributes and survival factors (A, LA)
- 3 2 1 0 24. Identify and distinguish diverse biomes (S)

### **Biotechnology**

- 3 2 1 0 25. Define biotechnology (S, LA)
- 3 2 1 0 26. Analyze issues related to biotechnology and the environment (S)
- 3 2 1 0 27. Assess the benefits of living organisms to biotechnology(S)
- 3 2 1 0 28. Identify and explain applications of genetic engineering in environmental science (S)

### **Soils**

- 3 2 1 0 29. Classify basic soil properties and formation (S)
- 3 2 1 0 30. Determine basic soil properties and limitations, such as mottling and permeability, by observing a soil pit or soil profile (S)
- 3 2 1 0 31. Identify causes and types of soil erosion and discuss methods of soil conservation (S)
- 3 2 1 0 32. Utilize soil information, including soil surveys, in land use planning (E)
- 3 2 1 0 33. Analyze how point and non-point pollution effect soil
- 3 2 1 0 34. Describe soil degradation
- 3 2 1 0 35. Take soil samples to have them evaluated by K-State Research and 3 2 1 0 36. Compare local soil test with K-State Research and Extension (E)
- 3 2 1 0 37. Calculate slope, % soil loss and soil depth (M), E
- 3 2 1 0 38. Demonstrate safety procedures when working with and around surveying and soil analysis equipment (CD, E)

### **Water Supply and Management and Quality**

- 3 2 1 0 39. Describe the composition and uses of water (LA)
- 3 2 1 0 40. Identify sources of water (S)
- 3 2 1 0 41. Conduct a water quality test (E,S)
- 3 2 1 0 42. Demonstrate proper safety using water test equipment (CD, E)
- 3 2 1 0 43. Illustrate the process of the water cycle (S)

## **21048 WORKPLACE EXPERIENCE**

- 3 2 1 0 1. Employ effective listening skills when working with client.
- 3 2 1 0 2. Employ customer service principles when working with consumers.
- 3 2 1 0 3. Evaluate and follow-up on customer service provided.
- 3 2 1 0 4. Employ safety skills and equipment usage in appropriate ways.
- 3 2 1 0 5. Be aware of MSDS (Material Safety Data Sheets) and other safety resources and employ those resources as required for the workplace.

Additional competencies should reflect the particular work environment and the essential skills addressed reflective of previous coursework

## **21015 PARTICULAR TOPICS IN ENGINEERING**

Coursework should represent explicit objectives measured against target skills that are not available in other courses and should be enumerated in addition to those listed below.

Possible topics (you will have others):

- Advanced Engineering Design
- Design Improvement Methodology (including and beyond those listed below)
  - Employ effective listening skills when working with client.
  - Employ customer service principles when working with consumers.
  - Evaluate and follow-up on customer service provided.
- Emerging Technology Utilization/Employment (beyond the Emerging Technology Course)

Additional competencies should reflect the particular work environment and the essential skills addressed reflective of previous coursework.

- 3 2 1 0 1. Define scope of work (or area to be researched) and appropriately document the process.
- 3 2 1 0 2. Summarize the process of engineering a new design or utilization of material to be examined.
  - a. Plan for products/services using reliability factors.
  - b. Demonstrate knowledge of the key functions and subsystems of the product.
  - c. Demonstrate knowledge of cross-functional team structures and team members' roles.
  - d. Create/evaluate products/services using reliability factors.
  - e. Identify testing methodologies, and system analysis requirements.
- 3 2 1 0 3. Assess the importance of new technology to future developments
- 3 2 1 0 4. Identify trends and major current



issues associated with topic  
3 2 1 0 5. Demonstrate in depth knowledge resulting from the topic examined (presentation, demonstration, etc).

## **21205 PROJECT MANAGEMENT AND RESOURCE SCHEDULING**

- 3 2 1 0 1. Recognize different resource types (Work, Material, Cost, Budget, Personnel/Skills, Generic, etc)
- 3 2 1 0 2. Understand the concept of scope and demonstrate in context of assessing the size of a project.
- 3 2 1 0 3. Develop plans for project management and resource scheduling.
- 3 2 1 0 4. Identify key personnel and responsibilities for project.
- 3 2 1 0 5. Develop SWOT analysis [Strengths, Weaknesses, Opportunities, and Threats] for project.
- 3 2 1 0 6. Analyze workload of tasks and projects.
- 3 2 1 0 7. Determine required personnel groups and management hierarchy.
- 3 2 1 0 8. Determine resources necessary for project completion.
- 3 2 1 0 9. Determine essential tasks necessary for project completion.
- 3 2 1 0 10. Design potential timelines for assignments.
- 3 2 1 0 11. Explore appropriate technologies for project management and resource scheduling.
- 3 2 1 0 12. Create and present a project management and resource scheduling plan.
- 3 2 1 0 13. Create Gantt charts.

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- 3 2 1 0 14. Evaluate and assign resources to tasks.
- 3 2 1 0 15. Implement project management skills to design and complete a collaborative project.
- 3 2 1 0 16. Learn various survey strategies to track project progress.
- 3 2 1 0 17. Develop strategies for monitoring interconnected assignments.
- 3 2 1 0 18. Survey strategies for critical path scheduling.
- 3 2 1 0 19. Create strategies to manage project budgets.
- 3 2 1 0 20. Build survey analysis for customer satisfaction

## **21016 RESEARCH IN ENVIRONMENTAL SCIENCE & ENGINEERING**

- 3 2 1 0 1. Collect environmental data (e.g. pollution emission measurements, atmospheric monitoring measurements, meteorological and mineralogical information, and soil or water samples).
- 3 2 1 0 2. Synthesize environmental data (e.g. pollution emission measurements, atmospheric monitoring measurements, meteorological and mineralogical information, and soil or water samples).
- 3 2 1 0 3. Analyze environmental data (e.g. pollution emission measurements, atmospheric monitoring measurements, meteorological and mineralogical information, and soil or water samples).
- 3 2 1 0 4. Report environmental data (e.g. pollution emission measurements, atmospheric monitoring measurements, meteorological

and mineralogical information, and soil or water samples).

- 3 2 1 0 5. Analyze data to determine validity, quality, and scientific significance between human activities and environmental effects
- 3 2 1 0 6. Interpret scientific and technical information to the public, organizations, or internal audiences.
- 3 2 1 0 7. Critique environmental technical standards, guidelines, policies, and formal regulations.
- 3 2 1 0 8. Prepare charts or graphs from data samples and provide summary information on the environmental relevance of the data.
- 3 2 1 0 9. Select the appropriate data collection methods to be employed in various research projects and surveys.
- 3 2 1 0 10. Summarize and report on accidents affecting the environment.
- 3 2 1 0 11. Analyze sources of pollution to determine their effects on the environment.
- 3 2 1 0 12. Describe the appropriate theories or methods of pollution abatement or control in provided theoretical situations.
- 3 2 1 0 13. Conduct applied research on the effects of industrial processes on the protection of protected species in the natural environment.
- 3 2 1 0 14. Evaluate the effects of industrial processes on the restoration of species to the natural environment.
- 3 2 1 0 15. Research the effects of industrial processes on the reintroduction of species to the natural environment.

- 3 2 1 0 16. Predict the future status or condition of ecosystems, based on changing industrial practices or environmental conditions.
- 3 2 1 0 17. Compile databases of information about energy alternatives related to ecological change.
- 3 2 1 0 18. Compile databases of information about pollutants related to ecological change.
- 3 2 1 0 19. Create databases of information about industrial processes, and other information related to ecological change.
- 3 2 1 0 20. Carry out simple environmental assessments in accordance with applicable standards, regulations, or laws.
- 3 2 1 0 21. Conduct scientific protection, mitigation, or restoration projects to prevent resource damage, maintain the integrity of critical habitats, and minimize the impact of human activities
- 3 2 1 0 22. Evaluate protocols to monitor ecosystem components and ecological processes.
- 3 2 1 0 23. Investigate the impact of changed land management or land use practices (in your area) on ecosystems.
- 3 2 1 0 24. Compare alternative energy investment scenarios to compare economic and environmental costs and benefits
- 3 2 1 0 25. Critique new or modified policies involving use of traditional and alternative fuels, transportation of goods, and other factors relating to climate and climate change.

- 3 2 1 0 26. Prepare reports, sketches, working drawings, or specifications for a proposed site restoration.
- 3 2 1 0 27. Analyze local water quality and issues related to pollution management, river control, or ground and surface water resources.
- 3 2 1 0 28. Conduct assessments to certify a habitat or to ascertain environmental damage or restoration needs at a local site.
- 3 2 1 0 29. Generate a habitat management or restoration plan, such as native tree restoration and weed control for a local site.
- 3 2 1 0 30. Communicate findings of environmental studies or proposals for environmental remediation to local governmental authorities.
- 3 2 1 0 31. Measure and graph local phenomena such as lake levels, stream flows, or changes in water volumes.
- 3 2 1 0 32. Conduct, or oversee the conduct of, chemical, physical, or biological water quality monitoring or sampling at a local site to ensure compliance with local water quality standards.
- 3 2 1 0 33. Develop a plan to protect local watershed health or rehabilitate watersheds.
- 3 2 1 0 34. Identify and characterize specific causes or sources of local water pollution.

## 37506 ENVIRONMENTAL RESOURCES AND WILDLIFE SCIENCE

### Our Natural Resources

- 3 2 1 0 1. Describe the environment and how human activity causes change (S, SS, LA)
- 3 2 1 0 2. Explain natural resources, and list examples (S, LA)
- 3 2 1 0 3. Contrast and compare renewable and nonrenewable natural resources (S, LA)
- 3 2 1 0 4. List natural resources found in Kansas (S)
- Sustaining the Environment**
- 3 2 1 0 1. Describe the importance of sustainability
- 3 2 1 0 2. Appraise the need for biodiversity (S)
- 3 2 1 0 3. Explain the basic life needs that the environment provides (S, LA)
- 3 2 1 0 4. Identify three roles of humans in the environment (LK MS 18)
- Resource Conservation**
- 3 2 1 0 1. Contrast and** compare conservation and preservation (LA)
- 3 2 1 0 2. Identify ways humans affect resources
- Human Population Growth and Demand**
- 3 2 1 0 1. Describe world population changes and trends and interpret graphs and maps (SS, LA)
- 3 2 1 0 2. Create a timeline on how population changes occur (E, SS)
- 3 2 1 0 3. Identify and explain three major problems associated with overpopulation (SS, LA)
- Biology and the Environment**
- 3 2 1 0 1. Utilize the taxonomy** of living things (S)
- 3 2 1 0 2. Classify organisms by their role in the environment (S)
- Organisms and the Environment**
- 3 2 1 0 1. Construct a life span of two different types of animals (S,E)
- 3 2 1 0 2. Describe the life processes essential for life (S, LA)
- 3 2 1 0 3. Compare and contrast the structure of living organisms (S, LA)
- 3 2 1 0 4. Relate heredity, genetics, and biodiversity to the environment (S)

## **Earth Science and the Environment**

3 2 1 0 1. Identify the six areas of earth science (S)

### **Applying Ecology**

3 2 1 0 1. Define ecology and ecosystems (S, LA)

3 2 1 0 2. Describe natural selection, adaptation and succession (S, LA)

3 2 1 0 3. Define population attributes and survival factors (A, LA)

3 2 1 0 4. Identify and distinguish diverse biomes (S)

### **Biotechnology**

3 2 1 0 1. Define biotechnology (S, LA)

3 2 1 0 2. Analyze issues related to biotechnology and the environment (S)

3 2 1 0 3. Assess the benefits of living organisms to biotechnology(S)

3 2 1 0 4. Identify and explain applications of genetic engineering in environmental science (S)

### **Soils**

3 2 1 0 1. Classify basic soil properties and formation (S)

3 2 1 0 2. Determine basic soil properties and limitations, such as mottling and permeability, by observing a soil pit or soil profile (S)

3 2 1 0 3. Identify causes and types of soil erosion and discuss methods of soil conservation (S)

3 2 1 0 4. Utilize soil information, including soil surveys, in land use planning (E)

3 2 1 0 5. Analyze how point and non-point pollution effect soil

3 2 1 0 6. Describe soil degradation

3 2 1 0 7. Take soil samples to have them evaluated by K-State Research and Extension (E)

3 2 1 0 8. Compare local soil test with K-State Research and Extension (E)

3 2 1 0 9. Calculate slope, % soil loss and soil depth (M), E

3 2 1 0 10. Demonstrate safety procedures when working with and around surveying and soil analysis equipment (CD, E)

### **Water Supply and Management and Quality**

3 2 1 0 1. Describe the composition and uses of water (LA)

3 2 1 0 2. Identify sources of water (S)

3 2 1 0 3. Conduct a water quality test (E,S)

3 2 1 0 4. Demonstrate proper safety using water test equipment (CD, E)

3 2 1 0 5. Illustrate the process of the water cycle (S,)

3 2 1 0 6. Describe the chemical and physical properties of water (S, LA)

3 2 1 0 7. Delineate the watershed boundary for a small water body

3 2 1 0 8. Explain the different types of aquifers and how they relate to water quantity and quality (S, LA)

3 2 1 0 9. Describe the benefits of wetlands and riparian areas, both function and value (LA, S)

3 2 1 0 10. Know methods used to sample, assess and manage aquatic environments.

3 2 1 0 11. Utilize water quality information to assess the general water quality of a given body of water (E)

3 2 1 0 12. Distinguish between methods and laws used to protect water quality to make management decisions

### **Aquatics**

3 2 1 0 1. Identify common aquatic organisms, aquatic plants, fish, game and other

3 2 1 0 2. Describe the changes to the aquatic ecosystem based on alteration of an aquatic habitat (S, LA)

3 2 1 0 3. List characteristics of common freshwater fish (S)

3 2 1 0 4. Research the fish trade industry (LA)

3 2 1 0 5. Identify native Kansas fish (S)

3 2 1 0 6. Develop a management plan for a farm pond for sport fishing (E)

### **Plants**

**3 2 1 0 1.** *Identify common grasses, shrubs, weeds, and wildflowers (S)*

3 2 1 0 2. Distinguish between domesticated and wild plants (S)

3 2 1 0 3. Describe types of plants based on life cycle and vegetative growth (S, LA)

3 2 1 0 4. Compare and contrast how wildlife plants are depleted and regenerated (S, LA)

3 2 1 0 5. Evaluate a grassland for signs of wildlife habitat (E)

3 2 1 0 6. Demonstrate safe handling of all plant species (E)

3 2 1 0 7. Demonstrate safe operation of tools and equipment (CD, E)

3 2 1 0 8. Attend or compete in Environmental Science or Natural Resource related CDE (CD, L, E)

### **Forestry**

3 2 1 0 1. Identify common trees found in Kansas (S, E)

3 2 1 0 2. Describe forest ecology concepts and factors affecting them (S, LA)

3 2 1 0 3. Define the cause and effect relationship of factors affecting tree growth and forest development (climate, insects, microorganisms, wildlife, etc.) (S,LA)

3 2 1 0 4. Explain the value of trees in urban and suburban settings and factors affecting their health and survival (S, LA)

3 2 1 0 5. Compare how the following issues are affected by forest health and management: biological diversity, forest

fragmentation, air quality, fire and recreation (S, LA)

- 3 2 1 0 6. Apply basic forest management concepts and tools such as: (E, CD)
- How silviculture practices are utilized
  - Use of tree measuring devices, i.e. Biltmore stick
  - Best management practices (CD)
- 3 2 1 0 7. Calculate board feet, tree height, tree diameter, number of logs in the standing tree (M, E)

#### **Wildlife**

- 3 2 1 0 1. Distinguish between domesticated animals and wildlife animals (S)
- 3 2 1 0 2. Identify common wildlife species based on wildlife signs including fur, hair, feathers, gnawing, nests, rubbings, pellets, tracks, bird calls, and scat from list provided (S)
- 3 2 1 0 3. Identify basic wildlife survival needs (CD)
- 3 2 1 0 4. Describe predator-prey relationships and examples (S, LS)
- 3 2 1 0 5. Describe the potential impact of the introduction of non-native species (S, LA)
- 3 2 1 0 6. Describe the major factors affecting threatened and endangered species and methods used to improve the populations of these species (S, LA)
- 3 2 1 0 7. Describe ways habitat can be improved for specific species by knowing their requirements (S, LA)
- 3 2 1 0 8. Discuss the concepts of carrying capacity and limiting factors (M, LA)
- 3 2 1 0 9. Analyze various ways the public and wildlife managers can help in the protection, conservation, and management of wildlife species (SS)

- 3 2 1 0 10. Evaluate a given habitat for its suitability for designated species, given a description of their habitat needs (E)
- 3 2 1 0 11. Demonstrate hunter safety (E)
- 3 2 1 0 12. Describe how hunting regulates animal populations
- 3 2 1 0 13. List legal regulations that apply to hunting and trapping (SS)

#### **Air Quality**

- 3 2 1 0 1. Describe how air pollution is tested and measured (LA)
- 3 2 1 0 2. Describe the kinds and sources of air pollution (LA)
- 3 2 1 0 3. Explain the effects of air pollution on humans and other living things (LA)
- 3 2 1 0 4. Compare and contrast procedures to lesson air pollution dangers (LA)
- 3 2 1 0 5. Understand the purpose of the Clean Air Act (SS)

#### **Wastewater**

- 3 2 1 0 1. Identify the kinds and sources of wastewater
- 3 2 1 0 2. Describe the hazards in wastewater (LA)
- 3 2 1 0 3. Compare ways of treating wastewater
- 3 2 1 0 4. Describe the products of wastewater treatment (LA)
- 3 2 1 0 5. Explain important biological and chemical processes in wastewater treatment (S, LA)

#### **Solid Waste**

- 3 2 1 0 1. Describe the kinds and sources of solid waste (LA)
- 3 2 1 0 2. Explain hazards in solid waste materials and disposal (LA)
- 3 2 1 0 3. Describe ways of disposing of solid wastes (LA)
- 3 2 1 0 4. Create a recycling system (E)
- 3 2 1 0 5. Describe composting (LA)

#### **Hazardous Wastes**

- 3 2 1 0 1. Explain hazardous wastes (LA)
- 3 2 1 0 2. Classify wastes on the basis of hazards
- 3 2 1 0 3. Analyze ways of disposing of hazardous wastes
- 3 2 1 0 4. Describe ecotoxicology (LA)
- 3 2 1 0 5. Describe procedures for handling hazardous waste spills (LA)

#### **Sustainable Agriculture**

- 3 2 1 0 1. Explain sustainable agriculture (LA)
- 3 2 1 0 2. Describe sustainable agricultural practices (LA)
- 3 2 1 0 3. Describe the use of nutrient management (LA)
- 3 2 1 0 4. Explain site specific agriculture and the use of GPS (S)
- 3 2 1 0 5. Demonstrate GPS/GIS use (S, E)

#### **Sustaining Wildlife**

- 3 2 1 0 1. Explain the classes of wildlife that need protection (LA)
- 3 2 1 0 2. Identify endangered wildlife (S)
- 3 2 1 0 3. Evaluate why wildlife species are vulnerable to extinction
- 3 2 1 0 4. Describe legal regulations and practices that protect endangered wildlife (SS)

#### **Energy**

- 3 2 1 0 1. Explain major sources of energy
- 3 2 1 0 2. Describe ways of conserving energy (LA)
- 3 2 1 0 3. Identify alternative sources of energy

#### **Wetlands**

- 3 2 1 0 1. Compare and contrast between the kinds of wetlands (LA, S)
- 3 2 1 0 2. Explain the importance of wetlands (S, LA)
- 3 2 1 0 3. Identify wetland areas of Kansas (SS)
- 3 2 1 0 4. Describe how humans damage wetlands (LA)

- 3 2 1 0 5. Explain three ways humans can improve wetlands (LA, S)

**Global Environmental Issues**

- 3 2 1 0 1. Explain the importance of global environment (SS, LA)
- 3 2 1 0 2. Describe war and terrorism as a threat to global environment (SS, LA)
- 3 2 1 0 3. Explain landscape degradation (LA)
- 3 2 1 0 4. Describe acid rain and how it is prevented (S, LA)
- 3 2 1 0 5. Describe ozone destruction and global warming and how they can be prevented (LA, S)
- 3 2 1 0 6. Explain the importance of rain forests and the effects of their destruction (S, LA)
- 3 2 1 0 7. Select a local issue and suggest ways to resolve the issue (LA, SS, L, E)
- 3 2 1 0 8. Visit waste or landfill facilities, wastewater treatment facilities, recreation areas, recycling centers, wetlands, etc (E)

**Future Environments**

- 3 2 1 0 1. Describe the role of forecasting and futuring in environmental science and technology (LA)
- 3 2 1 0 2. Develop an environmental plan (E)
- 3 2 1 0 3. Explain four examples of planning (L)

**Environmental Agencies and Organizations**

- 3 2 1 0 1. Categorize agencies that have a major emphasis in environmental science and technology and give the general purpose of the agency (E)
- 3 2 1 0 2. Categorize organizations that have a major emphasis in environmental science and technology and give the general purpose of the organization (E)

**Preparing for an Environmental Career**

- 3 2 1 0 1. Identify career areas within the environmental systems and natural resources career clusters (CD) (LK HS 123)
- 3 2 1 0 2. Research and report on the education and skills needed, salary expectations and work required for a career in the two clusters (CD, LA, E)

