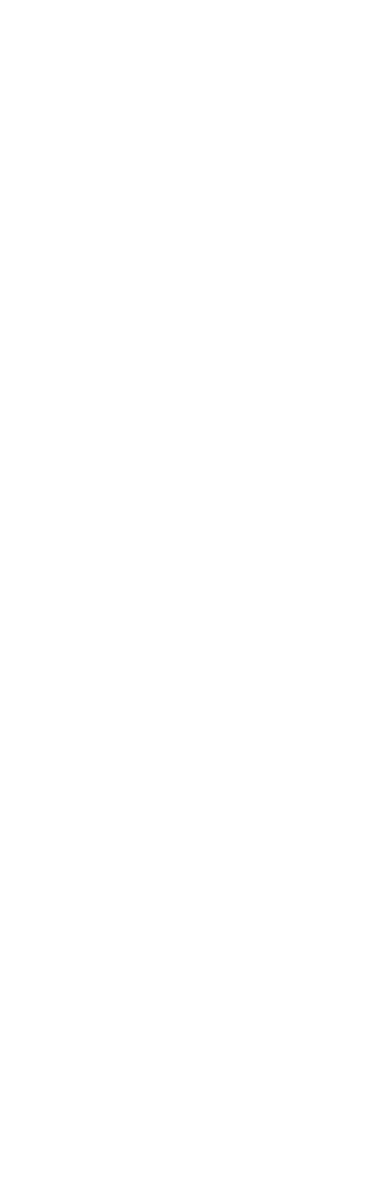
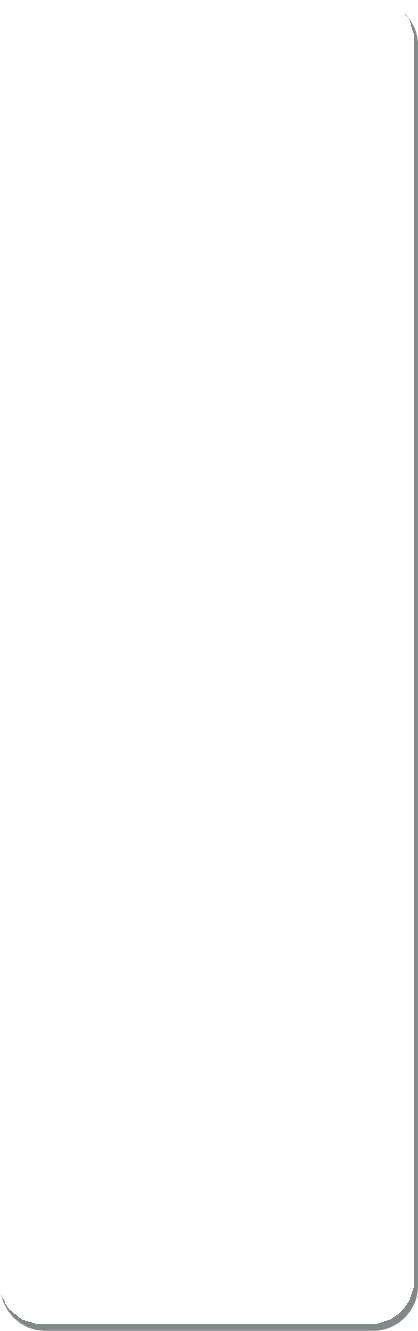
**ENGINEERING CAREER CLUSTER DESIGN**



**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.

Cartography/Geospatial/Spatial Mathematics Pathway – CIP Code 15.1102

***INTRODUCTORY LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [Earth Science or](#_bookmark6) | [03001](#_bookmark6) | 1 credit | [Engineering Appl. (8-9)](#_bookmark2) | [21002/71002](#_bookmark2) | 1 credit |
| [Earth Space Science](#_bookmark7) | [53008/03008](#_bookmark7) | 1 credit | [Engineering Tech. (8-9)](#_bookmark3) | [21003/71003](#_bookmark3) | 1 credit |
| [Computing Systems (8-9)](#_bookmark5) | [10002/60002](#_bookmark5) | 1 credit | [Principles of Tech. (8-9)](#_bookmark0) | [53153/03153](#_bookmark0) | 1 credit |
| [Computer Applications (8-9)](#_bookmark4) | [10004/60004](#_bookmark4) | 1 credit | [Pre-Engineering Tech (8-9)](#_bookmark1) | [21001](#_bookmark1) | 1 credit |
| [Physical Geography](#_bookmark8) | [03007](#_bookmark8) | 1 credit |  |  |  |

***TECHNICAL LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [Meteorology](#_bookmark9) | [03006](#_bookmark9) | 1 credit | [Animation](#_bookmark11) | [10210](#_bookmark11) | 1 credit |
| [GIS Technology](#_bookmark10) | [21058](#_bookmark10) | 1 credit | [Robotics](#_bookmark12) | [21009](#_bookmark12) | 1 credit |
| [Aerospace Technology](#_bookmark11) | [21055](#_bookmark11) | 1 credit |  |  |  |

***APPLICATION LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [GIS Spatial Applications](#_bookmark12) | [21112](#_bookmark12) | 1 credit | [Emerging Technologies in STEM](#_bookmark16) | [21053](#_bookmark16) | 1 credit |
| [Civil Engineering or](#_bookmark13) | [2101](#_bookmark13)1 | 1 credit |  |  |  |
| [Civil Eng. & Architecture](#_bookmark14) | [21012](#_bookmark14) | 1 credit | [Project Management](#_bookmark17) |  |  |
| [Aerospace Engineering](#_bookmark15) | [21013](#_bookmark15) | 1 credit | [and Resource Scheduling](#_bookmark17) | [21205](#_bookmark17) | 1 credit |
| [Particular Topics in Engineering](#_bookmark16) | [21015](#_bookmark16) | 1 credit | [Workplace Experience](#_bookmark17) | [21048](#_bookmark17) | 1 credit |

## Course appropriate for Project Lead the Way Programs; competencies may be utilized by any/all schools.

Course appropriate for Engineering by Design Programs; competencies may be utilized by any/all schools

**KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE ENGINEERING CLUSTER**

CARTOGRAPHY/GEOSPATIAL/SPACIAL MATHEMATICS PATHWAY (C.I.P. 15.1102)

Graduation Date

**I certify that the student has received training in the areas indicated.** Instructor Signature Instructor Signature Instructor Signature

Instructor Signature

**STUDENT**

**Rating Scale:**

**3 - Proficient Achievement 2 - Limited Achievement**

**1 - Inadequate Achievement 0 - No Exposure**

### 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.

1. Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
2. Demonstrate technical skills needed in a chosen STEM field.

### INTRODUCTORY LEVEL COURSES

**03153 Principles of Technology**

3 2 1 0 1. The student works safely with mechanical, fluid, electrical, and thermal technology.

1. Student will master relevant safety tests
2. Student will follow safety manuals, instructions, and requirements
3. Student will make prudent choices in the conservation and use of resources and the disposal of materials
4. Student will appropriately utilize laboratory equipment to accomplish activities of lesson
5. Student will know the location of the MSDS utilized in the work environment

3 2 1 0 2. The student uses a systems approach to investigate mechanical, fluid, electrical, and thermal systems.

1. Student will apply the universal

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | systems model to technological activities; and  b. Student will identify the |  |  | unbalanced; and  d. Student will measure force in mechanical, fluid, electrical, and | c. Student will measure, verify, and analyze resistance in mechanical, fluid, electrical, |
| inputs, processes, |  |  | thermal systems. | and thermal energy systems. |
| outputs, and feedback | 3 2 1 0 | 5. | The student knows the concept of | 3 2 1 0 9. The student knows the concept of |
| associated with each of |  |  | work. | energy. |
| the systems. |  |  | a. Student will relate mechanical, | a. Student will identify the nature of |
| 3 2 1 0 | 3. The student knows the laws governing |  |  | fluid, and electrical to force and | energy; |
|  | motion.  a. Student will analyze examples of |  |  | movement; and  b. Student will identify and | b. Student will relate potential energy, kinetic energy, and heat |
|  | uniform and accelerated motion, |  |  | measure the effects of work | energy to the conservation of |
|  | including linear, projectile, and |  |  | done in mechanical, fluid and | energy; |
|  | circular motion;  b. Student will generate and | 3 2 1 0 | 6. | electrical systems.  The student knows the concept of | c. Student will distinguish between work and energy; |
|  | interpret graphs describing  motion, including the use of real time technology;   1. Student will formulate the effects of forces on the motion of objects; 2. Student will develop and |  |  | rate.   1. Student will analyze rate in mechanical, fluid, electrical, and thermal systems; and 2. Student will measure, verify, and analyze rate in mechanical, fluid, electrical, and thermal systems. | 1. Student will measure, verify, and analyze energy in each system; and 2. Student will evaluate different methods of energy transfer that result in an increasing amount of disorder. |
|  | interpret a free-body diagram | 3 2 1 0 | 7. | Student knows electrical systems | 3 2 1 0 10. The student knows the concept of |
|  | for force analysis; and |  |  | concepts. | power. |
|  | e. Student will identify and |  |  | a. Student will identify and recreate | a. Student will define power in |
|  | describe motion related to |  |  | basic series and parallel circuits | mechanical, fluid, electrical, and |

different frames of reference. 3 2 1 0 4. The student knows the concept of

force.

1. Student will apply examples complex technological devices where force must be controlled, measured or applied;
2. Student will analyze the relationship among force, pressure, voltage, and temperature;
3. Student will evaluate and predict what happens to an object when forces on it are balanced and when forces on it are
   1. Students will appropriately utilize symbols on blueprints and charts related to electrical systems
   2. Students will identify and utilize various measures used in electrical systems and the associated tools

3 2 1 0 8. The student knows the concept of

resistance.

1. Student will identify resistance in mechanical, fluid, electrical, and thermal energy systems
2. Student will relate the principle of force divided by rate to resistance in each energy system

thermal systems; and

b.Student will relate the principle of work divided by time to each energy system.

3 2 1 0 11. The student knows the concept of energy transformation.

1. Student will observe and describe examples of kinetic and potential energy in mechanical, fluid, and electrical systems
2. Student will compare examples of energy transformations in mechanical, fluid, and electrical systems.

### St C

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 12. Students will work collaboratively with 3 2 1 0 9. Understand how electric and 3 2 1 0 18. Understand scalars and vectors. | | | | | | | |
| team members to complete an | | | |  | magnetic phenomena are related | 3 2 1 0 19. | Solve problems by using the |
| engineering project. | | | |  | and know common practical |  | concept of vectoring to predict the |
|  | | | |  | applications. |  | resultant forces. |
| **Fundamentals of electrical energy:** 3 2 1 0 20. Know the six simple machines and | | | | | | | |
| **21001 Pre-Engineering Technology** | | | 3 2 1 0 | 10. | Analyze relationships between |  | their applications. |
| **udents will:** voltage, current, resistance, and 3 2 1 0 21. Know how energy is transferred; | | | | | | | |
|  |  |  |  |  | power related to direct current (DC) |  | know the effects of resistance in |
| **ommunication and interpretation of information** circuits. mechanical, electrical, fluid, and | | | | | | | |
| **n industr**  3 2 1 0 | standard formats:  * + 1. Understand the classification and | | 3 2 1 0 | 11. | Understand the characteristics of  alternating current (AC) and how it | 3 2 1 0 22. | thermal systems.  Solve problems by using the |
|  |  | use of various components,  symbols, abbreviations, and media common to electronic and |  |  | is generated; the characteristics of the sine wave; the basic characteristics of AC circuits, tuned |  | appropriate units applied in mechanical, electrical, fluid, and thermal engineering systems. |

**i**

mechanical drawings.

3 2 1 0 2. Understand, organize, and

circuits, and resonant circuits; and the nature of the frequency

### Utilizing the design process to analyze and solve design problems:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| complete an assembly drawing by | | | | | spectrum. | 3 2 1 0 23. | Understand the steps in the design |
|  |  | using information collected from | 3 2 1 0 | 12. | Calculate, construct, measure, and |  | process. |
|  |  | detailed drawings. |  |  | employ both AC and DC circuits. | 3 2 1 0 24. | Determine what information and |
| 3 2 1 0 | 3. | Know the current industry |  |  |  |  | principles are relevant to a problem |
|  |  | standards for illustration and | 3 2 1 0 | 13. | Use appropriate electronic |  | and its analysis. |
|  |  | layout. |  |  | instruments to analyze, repair, or | 3 2 1 0 25. | Choose between alternate solutions |
| 3 2 1 0 | 4. | Draw flat layouts of a variety of |  |  | measure electrical and electronic |  | in solving a problem and be able to |
|  |  | objects by using the correct drafting |  |  | systems, circuits, or components. |  | justify the choices made in |
|  |  | tools, techniques, and media | 3 2 1 0 | 14. | Analyze and predict the effects of |  | determining a solution. |
| 3 2 1 0 | 5. | Prepare reports and data sheets for |  |  | circuit conditions on the basis of | 3 2 1 0 26. | Translate word problems into |
|  |  | writing specifications. |  |  | measurements and calculations of |  | mathematical statements when |

**Concepts of physics fundamental to engineering technology:**

voltage, current, resistance, and power.

appropriate.

3 2 1 0 27. Develop a solution from multiple

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| --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 6. | Understand Newton’s laws and how | 3 2 1 0 | 15. | Classify and use various electrical |  | details provided by client. |
|  | they affect and define the |  |  | components, symbols, | 3 2 1 0 28. | Build a prototype from plans and |
|  | movement of objects. |  |  | abbreviations, media, and |  | test it. |
| 3 2 1 0 7. | Understand how the laws of |  |  | standards of electrical drawings. | 3 2 1 0 29. | Evaluate and redesign a prototype |
|  | conservation of energy and | 3 2 1 0 | 16. | Understand how electrical control |  | on the basis of collected test data. |

momentum provide a way to predict and describe the movement of objects.

3 2 1 0 8. Analyze the fundamentals and

properties of waveforms and how waveforms may be used to carry energy.

and protection devices are used in electrical systems.

3 2 1 0 17. Calculate loads, currents, and

circuit-operating parameters.

### Principles of force, work, rate, power, energy, and resistance in mechanical, electrical, fluid, and thermal engineering systems:

**Industrial engineering processes, the use of tools and equipment, methods of measurement, and quality assurance:**

3 2 1 0 30. Know the common structure and processes of a quality assurance cycle.

3 2 1 0 31. Understand the major

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| 3 2 1 0 32. | manufacturing processes.  Use tools, fasteners, and joining | 3 2 1 0 43. | Understand the use of sensors for data collection and process | 3 2 1 0 | 6. | Describe the design process and how it is used to aid in problem |
|  | systems employed in selected |  | correction in an automated system. |  |  | solving. |
|  | engineering processes. | 3 2 1 0 44. | Program a computing device to | 3 2 1 0 | 7. | Use the design process to solve a |
| 3 2 1 0 33. | Estimate and measure the size of |  | control an automated system or |  |  | technical problem. |
|  | objects in both Standard  International and United States | 3 2 1 0 45. | process.  Use motors, solenoids, and similar | 3 2 1 0 | 8. | Recognize design criteria and  constraints. |
|  | units. |  | devices as output mechanisms in | 3 2 1 0 | 9. | Describe the purpose and |
| 3 2 1 0 34. | Calibrate and measure objects by |  | automated systems. |  |  | importance of working in a team. |
|  | using precision measurement tools  and instruments. | 3 2 1 0 46. | Assemble input, processing, and  output devices to create an | 3 2 1 0 | 10. | Explain a design brief and apply the  concept when using the design |
| **Computer systems and engineering perspective:** automated system capable of process. | | | | | | |
| 3 2 1 0 35. | Understand how to design systems | accurately completing a | | 3 2 1 0 | 11. | Describe the elements of design |
|  | that use computer programs to  interact with hardware. | preprogrammed task.  **Fundamentals of systems and products in phases** | |  |  | and apply this concept to the design  process. |
| 3 2 1 0 36. | Know the function and interaction | **of development, production, and marketing:** | | 3 2 1 0 | 12. | Use a decision matrix to select the |
| of basic computer components and | | 3 2 1 0 47. | Understand the process of product |  |  | best solution to a design problem. |
| peripherals.  3 2 1 0 37. Install and configure computer | | 3 2 1 0 48. | development.  Understand project management, | 3 2 1 0 | 13. | Demonstrate the ability to measure  accurately with different devices |
| hardware and software | |  | charting, and the use of graphic |  |  | and scales. |
| components required for solution. | |  | tools in illustrating the | 3 2 1 0 | 14. | Explain how to measure in different |
| 3 2 1 0 38. Understand the relationship among development of a product and the contexts.  computer hardware, networks, and processes involved. 3 2 1 0 15. Measure using both the English and | | | | | | |
| operating systems. | |  |  |  |  | Metric systems. |
| 3 2 1 0 39. Understand the process of testing 3 2 1 0 16. Summarize the reasoning for using | | | | | | |
| and troubleshooting computer **21002 Engineering Applications**  equipment and systems. **Design and Modeling** 3 2 1 0 | | | | | 17. | sketching as a communication tool.  Use visualization, spatial reasoning, |
| 3 2 1 0 40. Test and maintain wireless and 3 2 1 0 1. Explain the relationship between and geometric shapes to sketch two | | | | | | |
| wired communications components science, technology, engineering | | | | |  | and three dimensional shapes. |
| and systems. and math. 3 2 1 0 | | | | | 18. Recognize and create thumbnail, | |

### Students understand fundamental automation modules and are able to develop systems that complete preprogrammed tasks:

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| 3 2 1 0 41. | Use utility software efficiently to | 3 2 1 0 | 2. | Describe engineering and explain |
|  | diagnose and correct problems. |  |  | how engineers participate in or |

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| --- | --- | --- | --- | --- |
| 3 2 1 0 42. | Use appropriate tools and | has had on society. | | |
|  | technology to perform tests, collect | 3 2 1 0 | 4. | Distinguish between invention and |
|  | data, analyze relationships, and |  |  | innovation. |
|  | display data in a simulated or | 3 2 1 0 | 5. | Assemble an engineering notebook |
|  | modeled automated system. |  |  | and a portfolio. |

contribute to the invention and innovation of products.

3 2 1 0 3. Describe impacts that technology

using various sketching methods, notes, and drafting views.

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| --- | --- | --- |
|  | | 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 | |

### 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.

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| 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. **Science of Technology** 3 2 1 0 36. Analyze a product through testing  3 2 1 0 20. Describe the difference between a methods and make modifications to | | | | | | |
| 3 2 1 0 | 10. | Analyze the features and benefits chemist and a chemical engineer. the product. | | | | | | |
|  |  | of different types of wings. 3 2 1 0 21. Apply science and engineering skills **Magic of Electrons** | | | | | | |
| 3 2 1 0 | 11. | Describe the major parts (fuselage, |  |  | to make ice cream. | 3 2 1 0 | 37. | Identify the roles of protons, |
|  |  | empennage, high lift devices,  wings, undercarriage, propulsion, | 3 2 1 0 | 22. | Follow the design process to create  an adhesive. | 3 2 1 0 | 38. | neutrons, and electrons in an atom.  Identify an element based on the |

instruments, and controls) of aircraft and how they can affect the overall balance of an airplane during flight.

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|  | will affect the rocket’s performance. | 3 2 1 0 | 28. | Correctly identify the six simple machines and explain their |
| 3 2 1 0 16. | Know that a rocket must overcome |  |  | applications. |
|  | the forces of gravity and drag in | 3 2 1 0 | 29. | Distinguish between the three |
|  | order to get out of the |  |  | classes of levers. |
| 3 2 1 0 17. | atmosphere.  Understand that an orbit is the | 3 2 1 0 | 30. | Identify a machine as something  that helps use energy more |
|  | balance of gravity and an object’s |  |  | efficiently. |
|  | tendency to follow a straight path. | 3 2 1 0 | 31. | Determine mechanical advantage |
| 3 2 1 0 18. | Use an immersive learning  simulation to select optimal | 3 2 1 0 | 32. | from assembled simple machines.  Be able to compare and contrast |
|  | components for a lunar robot’s |  |  | kinetic and potential energy. |
|  | engine, power source, tires, body | 3 2 1 0 | 33. | Predict the relative kinetic energy |
|  | type and sensor system to save  stranded astronauts on the moon. |  |  | based on the mass and speed of the  object. |
| 3 2 1 0 19. | Understand the challenges that | 3 2 1 0 | 34. | Recognize and follow safety rules |
|  | engineers face to provide safe |  |  | for using lab tools and machines. |
|  | travel and optimum living  conditions in space. | 3 2 1 0 | 35. | Build, test, and evaluate a model of  a design problem. |

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

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| --- | --- | --- | --- | --- |
|  | | | | nanoscale. |
|  |  | 3 2 1 0 | 27. | Discuss the impact that  nanotechnology has on their lives |
|  |  |  |  | today and will have in the future. |

|  |  |  |
| --- | --- | --- |
|  | | 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 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

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 valance electrons and its position on the periodic table.

3 2 1 0 41. Explain how the Law of Charges

3 2 1 0 15. Investigate how changes in various design characteristics of a rocket

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| --- | --- | --- |
|  | | holds an atom together. |
| 3 2 1 0 | 42. | Explain how electrons transfer  from one atom to another to create electron flow. |

resistors, and photo resistors. 3 2 1 0 56. Determine the value of a fixed

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 43. | Define current, voltage, and resistance. | 3 2 1 0 | 58. | Mathematically calculate voltage, current, and resistance using |
| 3 2 1 0 | 44. | Measure voltage and current using |  |  | Ohm’s law. |
|  |  | a multimeter. | 3 2 1 0 | 59. | Create a circuit that uses a |
| 3 2 1 0 | 45. | Understand the properties of a |  |  | transistor as a switch. |
| 3 2 1 0 | 46. | magnet.  Build an electromagnet to | 3 2 1 0 | 60. | Interpret logic scenarios to  determine outputs based upon |
|  |  | demonstrate its characteristics and |  |  | possible conditions within those |
|  |  | functions. |  |  | scenarios. |
| 3 2 1 0 | 47. | Build a DC motor to identify the  primary parts and demonstrate | 3 2 1 0 | 61. | Distinguish between the functions  of NOT, AND, OR, NAND, NOR, and |
|  |  | how it functions. |  |  | XOR gates. |
| 3 2 1 0 | 48. | Build a generator to identify the | 3 2 1 0 | 62. | Create truth tables for logic |
|  |  | primary parts and demonstrate  how it functions. |  |  | scenarios and match those gates  to truth tables. |
| 3 2 1 0 | 49. | Understand the role of an | 3 2 1 0 | 63. | Convert binary numbers to Base- |
|  |  | electromagnet in the function of a |  |  | 10. |
|  |  | DC motor and generator. | 3 2 1 0 | 64. | Convert ACII characters to binary. |
| 3 2 1 0 | 50. | Compare the characteristics of a | 3 2 1 0 | 65. | Create a digital wave form and |
|  |  | basic motor and generator. |  |  | graph it for a binary sequence. |
| 3 2 1 0 | 51. | Build series, parallel, and | 3 2 1 0 | 66. | Communicate using electronic |
| 3 2 1 0 | 52. | combination electrical circuits.  Create circuit diagrams using | 3 2 1 0 | 67. | circuit diagrams.  Use transistors as switches to |
|  |  | standardized schematic symbols. |  |  | create circuits that function as |
| 3 2 1 0 | 53. | Build and test physical electrical |  |  | AND and OR gates. |
|  |  | circuits based upon circuit  diagrams. | 3 2 1 0 | 68. | Determine the logic, sensors,  gates, outputs, and other |
| 3 2 1 0 | 54. | Integrate DC sources, lamps, |  |  | components needed to emulate |
|  |  | switches, diodes, light emitting |  |  | existing electronic devices that |
|  |  | diodes, resistors, and capacitors  into electrical circuits to achieve | 3 2 1 0 | 69. | utilize logic.  Design, construct, and test device |
|  |  | specific functions. |  |  | solutions for emulating common |
| 3 2 1 0 | 55. | Distinguish between the |  |  | electronic devices that utilize logic. |
|  |  | functions and operations of  fixed resistors, variable |  |  |  |

resistor based upon the color codes on those resistors.

3 2 1 0 57. Measure voltage, current, and

resistance using a multimeter.

# 10004-Computer Applications

3 2 1 0 1. Personal Information Management

1. word usage, spelling, sentence structure, clarity, email
2. Demonstrate knowledge of email

etiquette.

1. Send email messages.
2. Access email attachments.
3. Attach documents to messages.
4. Demonstrate knowledge of contamination protection strategies for email.
5. Save email messages / attachments. 3 2 1 0 2. Research and Internet
6. Locate information using search

engine(s) and Boolean logic.

1. Navigate web sites using software functions.
2. Select appropriate search procedures and approaches.
3. Select search engine(s) to use.
4. Access business and technical information using the Internet.
5. Access commercial, government, and education resources.
6. Evaluate Internet resources (e.g., accuracy of information).
7. Explore browser features.
8. Test Internet connection.
9. Unpack files using compression software.
10. Bookmark web addresses (URLs).
11. Navigate web sites using software functions (e.g., Forward, Back, Go to, Bookmarks).

a. Create calendars/schedules.

1. Document results.
2. Create tasks (to-do) list.
3. Identify PIM applications (MS Outlook, Lotus Notes, and others).
4. Manage daily/weekly/monthly schedule using applications such as Notes, MS Outlook, etc.
5. Create and send notes, informal memos, reminder using PIM applications.
6. Create reminder for oneself.
7. Access email messages received.
8. Access email system using login and password functions.
9. Create e-mail messages in accordance with established business standards (e.g., grammar, Access library catalogs on the Internet.
10. Compile a collection of business sites (e.g., finance and investment).
11. Add plug-ins and helpers to the web browser.
12. Archive files.
13. Explore the multimedia capabilities of the World Wide Web.
14. Utilize online tools.
15. Communicate via email using the Internet.
16. Explore collaboration tools.
17. Explore electronic commerce.
18. Explore newsgroups.
19. Compile a collection of business sites (e.g., finance and investment).

3 2 1 0 3. Word Processing and Presentations

1. Create documents (e.g., letters, memos, reports) using existing

paint/draw functions.

1. Format new desktop publishing files.
2. Output desktop publishing files.
3. Place graphics in document.
4. Prepare publications using desktop publishing software.
5. Use advanced formatting features (e.g., headers/footers/dropped caps, and indexing).
6. Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication.
7. Edit presentations.
8. Insert graphic elements (e.g., graph, clip art, table) in a slide.
9. Identify hardware items that support presentation software (e.g., scanners, digital cameras, printers, and projection systems).
10. Print a single slide, an entire presentation, an outline, and notes.
11. Run slide shows manually and automatically.
12. Locate/replace data using search and replace functions.
13. Process data using database functions (e.g., structure, format, attributes, relationships, keys).
14. Perform single- and multiple-table queries (e.g., create, run, save).
15. Print forms, reports, and results or queries.
16. Search a database table to locate records.
17. Sort data using single and multiple field sorts.
18. Verify accuracy of output.
19. Maintain shared database of contact information.
20. Manage daily/weekly/monthly schedule using applications.
21. Participate in virtual group discussions and meetings.
22. Apply basic commands of operating system software.
23. Employ desktop operating skills.
24. Apply appropriate file and disk management

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| forms and templates. | | 3 2 1 0 | 4. Spreadsheets | |  | techniques. |
| b. | Employ word processing utility |  | a. | Create spreadsheets. | o. | Recognize the need for regular |
|  | tools (e.g., spell checker, |  | b. | Edit spreadsheets. |  | backup procedures. |
| c. | grammar checker, thesaurus).  Format text using basic formatting |  | c.  d. | Print spreadsheets.  Retrieve existing spreadsheets. | p. | Demonstrate knowledge of  central processing unit (CPU) |
|  | functions. |  | e. | Save spreadsheets. |  | control and architecture. |
| d. | Retrieve existing documents. |  | f. | Create charts and graphs from | q. | Identify CPU modes of operations. |
| e. | Safeguard documents using name &  save functions. |  | g. | spreadsheets.  Group worksheets. | r. | Define the role of memory  management in an operating system. |
| f. | Create new word processing forms, |  | h. | Input/process data using | s. | Demonstrate knowledge of network |
|  | style sheets, and templates. |  |  | spreadsheet functions. |  | operating systems. |
| g. | Enhance publications using |  | i. | Perform calculations using simple | t. | Demonstrate knowledge of |
|  | different fonts, styles, attributes, |  | formulas. | |  | operating system architecture types. |
|  | justification, etc. | 3 2 1 0 | 5. Data | | u. | Demonstrate knowledge of the |
| h. | Enhance publications using |  | a. Enter data using a form. | |  | commands used to handle tasks in |

operating systems.

1. Differentiate between microcomputer, minicomputer, and mainframe operating systems.
2. Demonstrate knowledge of the basics of process management.
3. Demonstrate knowledge of the system utilities used for file management.

3 2 1 0 6. Ethics and Security

quality planning.

r. Identify the role of quality within the organization.

3 2 1 0 7. History / Quality Assurance

1. Demonstrate knowledge of changes brought about by quality industry leaders in the world.
2. Demonstrate knowledge of successful efforts by industry to improve quality and/or

procedure(s).

h. Handle materials and equipment in a responsible manner.

3 2 1 0 2. Clearly document procedures for future use.

1. Document step-by-step installation and configuration procedures.

3 2 1 0 3. Communicate and recognize goal achievement.

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| a.  b. | Demonstrate knowledge of  potential internal and external threats to security.  Assess exposure to security issues. | c. | reduce costs.  Demonstrate knowledge of the historical evolution of quality assurance/total quality | 3 2 1 0 | a.  b.  4. | Communicate goal achievement.  Provide recognition for goal achievement.  Configure systems to provide optimal |
| c. | Demonstrate knowledge of virus |  | management (e.g., Deming, ISO |  |  | system interfaces. |
|  | protection strategy. |  | 9000). |  | a. | Apply concepts of privileged |
| d. | Ensure compliance with security | d. | Demonstrate knowledge of the |  |  | instructions and protected mode |
| e. | rules, regulations, and codes.  Explore ways to implement |  | standards/requirements for the  Baldridge award. |  | b. | programming.  Configure peripheral device drivers |
|  | countermeasures. | e. | Demonstrate knowledge of quality |  |  | (e.g., disk, display, printer, modem, |
| f. | Implement security procedures |  | management terminology. |  |  | keyboard, mouse, network). |
|  | in accordance with business  ethics. |  |  |  | c. | Allocate disk space, non-sharable  resources, and I/O devices. |

* 1. Maximize threat reduction.
  2. Document security procedures.
  3. Understand how to follow a disaster plan.

# 10002 Computing Systems

3 2 1 0 1. Apply knowledge of operating

systems principles to ensure

d. Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts,

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| j.  k.  l.  m. | Identify sources of virus infections.  Understand how to utilize backup and recovery procedures.  Understand how to load virus detection and protection software. Maintain confidentiality. | **a.**  **b.**  **c.** | optimal functioning of system.  Interact with/respond to system messages using console device. Apply basic commands of operating system software.  Apply appropriate file and disk management techniques. |  | e.  f. | exceptions, Direct Memory  Addressing [DMA], bus structures). Identify standards and issues related to I/O programming and design of I/O interfaces.  Define hardware-software interface issues for a computer system. |
| n.  o. | Understand how to provide for user authentication (e.g., assign passwords, access level).  Understand how to remove viruses. | **d.**  **e.**  **f.** | Employ desktop operating skills.  Follow power-up and log-on procedures.  Run applications. jobs in |  | g. | Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats). |
| p. | Report viruses in compliance with company standards. |  | accordance with processing  procedures. | 3 2 1 0 | 5. | Configure/modify system as needed. |
| q. | Identify the features and benefits of | g. | Follow log-off and power-down |  | a. | Build system software command |

structures using operating system macro facilities for computer systems.

1. Identify scheduling priority in programming.
2. Identify data requirements.
3. Review automated scheduling software.
4. Secure needed supplies and resources.

3 2 1 0 6. Determine audience and

information needs

1. Define research questions.
2. Identify target audience.

3 2 1 0 7. Document procedures and actions.

1. Develop audit trails.

3 2 1 0 8. Ensure that hardware and software system components are compatible prior to performing installation.

1. processor, memory, disk space, communications, printers, monitors).
2. 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.

1. Verify conformance to licensing agreement.

3 2 1 0 10. Evaluate information systems

problem-solving techniques and approaches.

1. Evaluate systems engineering considerations.
2. Identify potential problems in system implementation.
3. Summarize application planning, development, and risk management for information system.
4. Demonstrate knowledge of

critical thinking skills and techniques.

1. Demonstrate knowledge of decision-making skills and techniques.
2. Develop a plan using data- oriented techniques.
3. Determine whether prototyping system is feasible.
4. Determine software design process, from specification to implementation.
5. Appraise software process and product life-cycle models.
6. Assess software design methods and tools.

3 2 1 0 11. Evaluate information.

1. Determine the accuracy and completeness of the information gathered.

3 2 1 0 12. Explain data communications

procedures, equipment and media.

1. Demonstrate knowledge of the uses of data communications media.
2. Demonstrate knowledge of the uses of data communications equipment.
3. . Demonstrate knowledge of key communications procedures.

3 2 1 0 13. Explain measurement

techniques for increased productivity due to information systems implementation.

1. Measure increases in productivity realized by the implementation of information systems.

3 2 1 0 14. Explain new and emerging classes of software.

1. 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).

1. 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.

1. Distinguish between local area networks and wide area networks.

3 2 1 0 17. Explain the features and functions of web browsing software.

1. Identify how different browsers affect the look of a web page.
2. Demonstrate knowledge of the characteristics and uses of plug- ins.
3. 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.

1. 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.

1. Demonstrate knowledge of the function and operation of compilers and interpreters.
2. Demonstrate knowledge of widely used software applications (e.g., word processing, database management, spreadsheet development).
3. Demonstrate knowledge of the key functions of systems software.

3 2 1 0 20. Explain the role of number systems

in information systems.

3 2 1 0 2

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| a. | Identify the role the binary system in information systems. |  | & to future knowledge worker productivity. | f. | procedures.  Disable/uninstall software that may |
| b. | Demonstrate knowledge of number | c. | Identify new & emerging drivers and |  | interfere with installation of new |
|  | systems and internal data |  | inhibitors of information technology |  | software. |
| representation. change. g. Install given application/system  1. Gather information. 3 2 1 0 24. Monitor and adjust goals. software on various platforms in | | | | | |

1. Identify potential sources of information.
2. Gather information from selected print and electronic sources.
3. Conduct interviews with selected human information sources.
4. Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).
5. Target audience/user group as a key information source.
6. Determine priorities for the information that should be gathered.
7. Identify subject-matter experts.

3 2 1 0 22. Identify computer classifications and hardware.

1. Identify types of computer storage devices.
2. Obtain support for goals.
3. Provide support for goals.
4. Monitor goal achievement.
5. Adjust goals.

3 2 1 0 25. Operate computer-driven equipment and machines.

1. Run applications/jobs in accordance with processing procedures.
2. Secure needed supplies and resources.
3. Interact with/respond to system messages using console device.
4. Follow log-off and power-down procedure(s).
5. Follow power-up and log-on procedures.

3 2 1 0 26. Perform customization as requested.

1. Customize software to meet user preferences.

3 2 1 0 27. Perform installation accurately and completely, using available

accordance with manufacturer’s procedures.

* 1. Convert data files if required.
  2. Verify software installation and operation.

3 2 1 0 28. Resolve problems with installation if they occur.

1. Access needed help using manufacturers' technical help lines or Internet sites.
2. Formulate new installation procedure if needed.
3. Troubleshoot unexpected results.
4. Set short- and long-term goals for assigned areas of responsibility/accountability.

3 2 1 0 29. Test and maintain products /

services.

1. Test products for reliability.
2. Initiate predictive maintenance

b. Identify the hardware

associated with telecommunications

resources as needed.

**a.** Select appropriate installation

options (e.g., default,

3 2 1 0 30.

procedures.

Troubleshoot computer-driven equipment and machines and access support as needed

functions.

1. Identify major hardware components and their functions.
2. 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.

1. Identify new technologies relevant to information technology.
2. Assess the importance of new technologies to future developments

customized).

1. Configure software to appropriate operating system settings.
2. Configure macros, tools, and packages to accomplish simple organizational and personal tasks.
3. Differentiate between procedures for an upgrade and for a new installation.
4. Differentiate between stand-alone and network installation
   1. Test system using diagnostic

tools/software.

* 1. Repair/replace malfunctioning hardware.
  2. Reinstall software as needed.
  3. Recover data and/or files.
  4. Restore system to normal operating standards.

3 2 1 0 31. Understand and employ design and color principles.

1. Assess the impact of various color harmonies on a two-dimensional picture plan.
2. Demonstrate knowledge of the two- dimensional picture plan.
3. Demonstrate knowledge of the

nature of color and color harmonies.

1. Assess how color affects the principles of line, value, shape and form.
2. 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.

1. Identify major current issues in data communications.
2. Identify data communication trends.
3. Demonstrate knowledge of data transmission codes and protocols.

3 2 1 0 33. Understand elements and

types of information processing.

1. Identify the elements of the information processing cycle (i.e., input, process, output, and storage).
2. 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.

1. Identify the ways in which organizational functions are interdependent.
2. Define the role of strategic planning in business.
3. Identify types of communication channels (e.g., formal, informal).
4. Demonstrate knowledge of the components of a business plan.

3 2 1 0 35. Understand how bandwidth affects data transmission and on-screen image.

1. 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.

1. Demonstrate knowledge of how data is organized in software development.

3 2 1 0 37. Understand information organization principles.

1. Demonstrate knowledge of group support technology for common knowledge requirements.
2. Demonstrate knowledge of methods for achieving productivity in knowledge work.
3. Demonstrate knowledge of the information analysis process.
4. Demonstrate knowledge of information technology solutions.

3 2 1 0 38. Understand product/service design.

1. Consider customer satisfaction in determining product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation).
2. Design product (e.g., using brainstorming, thumbnail sketches, rendering).

3 2 1 0 39. Understand the differences

between a client and a server.

1. Differentiate between a client and a server.

3 2 1 0 40. Understand the fundamentals of operating systems.

1. Identify major operating system fundamentals and components.

3 2 1 0 41. Understand the range of languages used in software development.

1. Demonstrate knowledge of the range of languages used in

software development.

3 2 1 0 42. Understand types and functions of businesses.

1. Define stakeholder relationships (e.g., customers, employees, shareholders, and suppliers).
2. Identify business reporting and information flow.
3. Identify types of business organizations and functions.

3 2 1 0 43. Use available reference tools as

appropriate.

1. Access needed information using appropriate reference materials.
2. 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.

1. Access needed information using appropriate reference materials.

3 2 1 0 45. Use reliability factors effectively to plan for and create products/ services.

1. Consider reliability factors (e.g., cost, human, productivity).
2. Achieve reliability through maintainability, good design, design simplification, and design redundancy.
3. Recognize the relationship of maintainability and reliability.
4. Align cost components with quality objectives.
5. Classify quality costs (e.g., preventive, evaluation, pre- delivery failures, post-delivery failures).

# 03001 Earth Science (or 53008/03008 – Earth Space Science)

### Knowledge of the nature of science

3 2 1 0 1. Evaluate models used in science to

explain patterns observed in nature (e.g., rock cycle, heliocentric, geocentric, nitrogen cycle, water cycle).

3 2 1 0 2. Evaluate the appropriate use of

inferences, assumptions, observations, hypotheses, conclusions, laws, and theories.

### Composition, characteristics, and structure of Earth

3 2 1 0 1. Identify the characteristics of Earth's

layers and the methods used to investigate Earth's interior.

3 2 1 0 2. Identify common rocks and minerals

based on their physical and chemical properties.

3 2 1 0 3. Identify processes and products within

the rock cycle.

### Plate tectonics and related processes

3 2 1 0 1. Identify the historical development and

supporting evidence that has led to the theory of plate tectonics.

3 2 1 0 2. Analyze the geologic processes involved

in the movement of tectonic plates

### Earth's surface processes

3 2 1 0 1. Compare physical and chemical

weathering and their effects on landforms.

3 2 1 0 2. Analyze the principles and processes of

sedimentation (i.e., erosion, deposition).

3 2 1 0 3. Identify the properties of aquifers and

the movement of groundwater through sediments and rock formations.

3 2 1 0 4. Analyze the movement of water

through the hydrologic cycle, including energy changes that occur as water changes phase.

### Mapping and remote sensing

3 2 1 0 1. Identify surface features from

topographic maps, photographs, and satellite images.

3 2 1 0 2. Interpret topographic and

oceanographic maps.

3 2 1 0 3. Evaluate the function and benefits of

Earth-observing systems (e.g., Landsat, Topex, aircraft, balloons).

### Geologic time

3 2 1 0 1. Identify appropriate methods of

absolute and relative dating for given situations.

3 2 1 0 2. Apply the law of original horizontality,

### Earth's resources

3 2 1 0 1. Identify characteristics of renewable

and nonrenewable resources. 3 2 1 0 2. Evaluate management strategies for

renewable and nonrenewable resources.

3 2 1 0 3. Compare various energy production

technologies (e.g., fossil fuels, nuclear, solar) and their past, present, and future consequences to the environment.

3 2 1 0 4. Identify the impact of humans on Earth

(e.g., deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water).

### Weather

3 2 1 0 1. Analyze the composition and structure

of the atmosphere and how it protects life and insulates the planet.

3 2 1 0 2. Differentiate between the sources,

characteristics, and movement of air masses (e.g., maritime, continental,

polar, tropical).

3 2 1 0 3. Determine how the transfer of energy

throughout the atmosphere influences weather conditions

3 2 1 0 3. Ide

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| and the landforms produced by | the principle of superposition, and | (e.g., hydrologic cycle). | |
| their movements. | the principle of cross-cutting | 3 2 1 0 4. Interpret weather maps and the | |
| ntify the types, causes, and effects relationships to interpret geologic  of volcanoes. cross sections. | | 3 2 1 0 | indicated atmospheric conditions.  5. Evaluate how local weather is affected |

3 2 1 0 4. Identify the causes and effects of

earthquakes and the characteristics of seismic waves.

3 2 1 0 5. Identify how the movement of tectonic

plates has influenced climate (e.g., hydrosphere, geosphere, biosphere).

3 2 1 0 3. Identify major events in Earth's history

(e.g., mass extinctions, evolution of plants, development of an oxygen- rich atmosphere).

3 2 1 0 4. Interpret fossils and geologic evidence

to reconstruct Earth's history.

by geographic features (e.g., proximity to bodies of water, urban versus rural settings, unequal heating of land and water).

3 2 1 0 6. Identify how global climate influences,

such as jet streams and ocean

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| currents, affect weather (e.g., El Niño). |  | infrared, radio telescopes, spectrometers). | 3 2 1 0 | 3. Identify and distinguish between the |
| **Climate patterns** | 3 2 1 0 | 3. Identify significant manned and |  | processes of physical and chemical |
| 3 2 1 0 1. Identify the causes and effects of |  | unmanned space exploration |  | weathering. |
| climate changes throughout |  | events, programs, and objectives. | 3 2 1 0 | 4. Describe and explain the Laws of |
| Earth's history.  3 2 1 0 2. Assess how the cycling of carbon, | 3 2 1 0 | 4. Identify the historical development of  astronomy based on the | 3 2 1 0 | Drainage composition.  5. Identify processes operating in the |
| energy, and water between the |  | contributions of Aristotle, Ptolemy, |  | fluvial, glacial and shoreline |
| geosphere, hydrosphere, and |  | Copernicus, Brahe, Kepler, Galileo, |  | environments. |
| atmosphere affects climate.  3 2 1 0 3. Determine the effects of climate | **Oceans** | Newton, Einstein, and Hubble.  **and coastal processes (OPTIONAL)** | 3 2 1 0 | 6. Explain the concept of dynamic  equilibrium. |
| phenomena (e.g., monsoons, jet | 3 2 1 0 | 1. Identify the characteristics of ocean | 3 2 1 0 | 7. Explain models of landform |
| streams, El Niño). |  | basins, continental shelves, and |  | development. |
| **Astronomical objects and processes**  3 2 1 0 1. Identify the characteristics (e.g., mass, | 3 2 1 0 | coral reefs.  2. Identify the geologic features of coastal | 3 2 1 0 | 8. Apply concepts of energy to explain  distributions of temperature, pressure, |
| composition, location) of the |  | geomorphic structures (e.g., |  | wind, and moisture. |
| major and minor objects in the |  | barrier islands, estuaries, sandbars, | 3 2 1 0 | 9. Explain and use concepts of the |
| solar system.  3 2 1 0 2. Interpret the Hertzsprung-Russell | 3 2 1 0 | capes, deltas, coral reefs).  3. Analyze the movement of water |  | adiabatic process to solve problems and  explain weather variations. |
| diagram with regard to stellar |  | through waves, tides, and | 3 2 1 0 | 10. Apply concepts of atmospheric physics |
| evolution and star characteristics. |  | currents. |  | to explain global climatic patterns. |
| 3 2 1 0 3. Identify the causes and effects of the  cycles of the Earth-Moon-Sun | 3 2 1 0 | 4. Identify the chemical, physical, and  biological characteristics of | 3 2 1 0 | 11. Relate the concept of index species to  climatic distributions. |
| system (e.g., seasons, tides, |  | seawater. | 3 2 1 0 | 12. Discuss aspects of climatic change. |
| eclipses, | 3 2 1 0 | 5. Determine the causes and effects of | 3 2 1 0 | 13. Identify rock classifications. |
| precession, moon phases).  3 2 1 0 4. Identify the physical properties of the |  | surface currents, coastal  upwelling, and density-driven (i.e., | 3 2 1 0 | 14. Compare and contrast thermal and  dynamic weather systems. |
| Sun, its dynamic nature, and its |  | thermohaline) circulation. | 3 2 1 0 | 15. Explain the process of photosynthesis. |
| effects on Earth systems. | 3 2 1 0 | 6. Identify the effects of human activity on | 3 2 1 0 | 16. Explain the Copernican Model |
| 3 2 1 0 5. Identify the matter and forces involved |  | the coastal and marine | 3 2 1 0 | 17. Identify the Kinetic Theory. |
| in the evolution of the universe |  | environment. | 3 2 1 0 | 18. Summarize the plate tectonic theory. |
| (e.g., big bang theory). |  |  | 3 2 1 0 | 19. Explain the laws of thermodynamics. |
| **Space exploration** |  |  | 3 2 1 0 | 20. Distinguish between tensional and |
| 3 2 1 0 1. Compare relative and absolute  methods for measurement of | **03007 Physical Geography** | | 3 2 1 0 | compressional landforms.  21. Describe volcanic activity related to |
| astronomical distances. | 3 2 1 0 | 1. Describe the concepts and |  | ejecta, plate tectonic activities, |
| 3 2 1 0 2. Evaluate functions and benefits of the |  | interrelationships between continental |  | and related features. |
| different types of ground- and  space-based astronomical |  | drift, plate tectonics, and sea-floor  spreading. | 3 2 1 0 | 22. Identify erosional and depositional  landforms. |

instruments (e.g., x-ray, optical,

3 2 1 0 2. Describe and explain the principles of

rock mechanics.

3 2 1 0 23. Describe thermal circulation and the differences between Sea Breezes vs.

Monsoonal Wind Systems

3 2 1 0 24. Deduce relationships between processes, features, and process- responses and be familiar with the basic assumptions of the scientific perspective.

3 2 1 0 25. Summarize the conditions that cause such natural hazards as floods, storms, earthquakes, landslides, volcanoes, and coastal erosion and explain their impact on human beings.

3 2 1 0 26. Describe the role water plays in physical geography (i.e. Heat storage, latent heat: gradational work performed by streams, waves, and glaciers)

3 2 1 0 27. Explain how hydrologic, tectonic, erosional and atmospheric processes as well as earth-sun relationships are interconnected and together shape the physical environment.

3 2 1 0 28. Locate major political and physical features of Earth from memory and compares the relative locations of those features.

3 2 1 0 29 Interpret maps and other graphic representations.

3 2 1 0 30. Demonstrate how various regional frameworks are used to interpret the complexity of Earth (e.g., vegetation, climate, religion, language, occupations, industries, resources, governmental systems, economic systems).

3 2 1 0 31. Analyze the distribution of ecosystems by examining relationships between soil, climate, plant, and animal life.

3 2 1 0 32. Analyze an ecosystem to understand and solve problems regarding environmental issues (e.g., carrying capacity, biological magnification, reduction

of species diversity, acid rain, ozone depletion, contamination)

3 2 1 0 33. Examines the impact that technology has on human modification of the physical environment (e.g., over-fishing, logging and mining, construction on floodplains, internal combustion engine, toxic waste).

### TECHNICAL LEVEL COURSES

**03006 Meteorology**

3 2 1 0 1. Define the role of meteorology as an academic discipline and identify potential career opportunities.

3 2 1 0 2. Explain how the Earth constitutes a single interconnected system of systems.

3 2 1 0 3. Summarize methods of interpreting and using current environmental data from local and remote sources.

3 2 1 0 4. Summarize the basic laws of physics and thermodynamics.

### Atmosphere

3 2 1 0 5. Describe what an atmosphere is and why it is important.

3 2 1 0 6. Describe and explain the origin, composition, structure, short-term and long-term behaviors of the earth’s atmosphere.

3 2 1 0 7. Compare and contrast the Earth’s atmosphere with the atmosphere of other planets in our solar system.

3 2 1 0 8. Demonstrate how to take air temperatures.

3 2 1 0 9. Examine forms of condensation.

3 2 1 0 10. Explain the connection between dew point and relative humidity.

3 2 1 0 11. Measure wind chill factor.

3 2 1 0 12. Relate air masses to weather fronts.

3 2 1 0 13. Identify the different types of storms and associated weather.

3 2 1 0 14. Explain the composition of the Earth’s atmosphere.

3 2 1 0 15. Identify the troposphere.

3 2 1 0 16. Describe the stratosphere.

3 2 1 0 17. Identify on a diagram where the mesosphere is located.

3 2 1 0 18. Describe the thermosphere.

### Solar Radiation

3 2 1 0 19. Describe how sunlight arrives as electromagnetic waves.

3 2 1 0 20. Explain how radiant energy from the sun provides energy and heat to the troposphere.

3 2 1 0 21. Summarize how the earth’s atmosphere and solar radiation interact.

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 | 22 | Identify what happens when heat is absorbed by gases, liquids, or solids. |
| 3 2 1 0 | 23. | Summarize what happens to light when  it passes through the atmosphere. |

### Atmospheric Conduction and Convection

3 2 1 0 24. Compare and contrast conduction and convection as ways that heat moves around the planet.

3 2 1 0 25. Explain how heat is transferred to other materials.

### Atmospheric Balancing

3 2 1 0 26. Summarize the three kinds of energy transfer- absorption, conduction and convection.

3 2 1 0 27. Describe the ocean system.

3 2 1 0 28. Explain how the atmosphere regulates the Earth’s temperature.

3 2 1 0 29. Outline how the atmosphere participates in a number of Bio/Geo/Chemical cycles that involve life itself.

### Bio/Geo/Chemical Cycles

3 2 1 0 30. Explain the water cycle.

3 2 1 0 31. Describe the role of solar energy in the water cycle.

3 2 1 0 32. Outline the sulfur cycle.

3 2 1 0 33. Describe the nitrogen cycle.

3 2 1 0 34. Explain the carbon cycle.

3 2 1 0 35. Identify the differences in the amount of carbon in the troposphere with the amount of carbon in the atmospheres of other planets.

### Atmosphere and Climate Change

3 2 1 0 36. Describe the properties of CO2 .

3 2 1 0 37. Explain the chemical composition of the Earth’s atmosphere.

3 2 1 0 38. States how industrial output can interact with the atmosphere through the various Bio/Geo/Chemical cycles, and as a result, can change the way the atmosphere regulates the heat coming from solar radiation.

# 21058 GIS Technology

3 2 1 0 1. Identify and describe careers in Geospatial and Geographic Information Systems.

3 2 1 0 2. Identify key figures and major innovations in the history of progression of diagrams, charts, maps, and projections.

3 2 1 0 3. Distinguish between diagrams, charts, maps and projections and identify specific features you would utilize to recognize each and how those features provide utility.

Example – a “Contour Map” is really a

projection/overlay that includes contour lines that depict varying levels of depth/altitude. It is often utilized in Agriculture and Natural Resources to examine erosion issues, water flow, and assist with land modification.

3 2 1 0 4. Of charts, maps, and projections, identify the primary usage, where each could be co-utilized, and where each has specific usage.

3 2 1 0 5. Create examples of typical keys/legends for sample diagrams, charts, maps, and projections that would illustrate awareness of usage.

3 2 1 0 6. Identify occupations, activities, and specializations and the types of specific utilization required of particular diagrams, charts, maps, and projections in each of these areas.

3 2 1 0 7. Identify and describe methods used to collect data for construction of diagrams, charts, maps and projections; describe modern and historic equipment.

3 2 1 0 8. Identify the file types associated with various types of data and various utilized formats; measurement, axis, reference, scale -- Excel, ArcGIS, PDF, SQL, etc

Example Important files :

.shp — shape format; the feature geometry itself

.shx — shape index format; a positional index of the feature geometry to allow seeking forwards and backwards quickly

.dbf — attribute format; columnar attributes for each shape, in dBase IV format

Example Optional Files:

.prj — projection format; the coordinate system and projection information, a plain text file describing the projection using [well-](http://en.wikipedia.org/wiki/Well-known_text) [known text](http://en.wikipedia.org/wiki/Well-known_text) format

.sbn and .sbx — [a spatial index](http://en.wikipedia.org/wiki/Spatial_index) of the features

.fbn and .fbx — a spatial index of the features for shapefiles that are read-only

.ain and .aih — an attribute index of the active fields in a table or a theme's attribute table

.ixs — a geocoding index for read-write shapefiles

.mxs — a geocoding index for read-write shapefiles (ODB format)

.atx — an attribute index for the .dbf file in the form of shapefile.columnname.atx (ArcGIS 8 and later)

.shp.xml — metadata in XML format

.cpg — used to specify the [code page](http://en.wikipedia.org/wiki/Code_page) (only for

.dbf) for identifying the [character encoding](http://en.wikipedia.org/wiki/Character_encoding)

3 2 1 0 9. Identify the file types associated with imaging [vector, raster, shapefiles, DWG, GML, TIF, GIF etc], and their potential usage, advantages, and disadvantages.

3 2 1 0 10. Describe shapefiles and how their utilization impacts projection and can facilitate orientation.

3 2 1 0 11. Describe the impact/facilitation of computers on collection and management of data in this field. Give examples of data that might be included; temperature, direction, elevation & distance, volume, etc.

3 2 1 0 12. Describe the impact/facilitation of computers on the projection/representation of data. Give examples such as graphs, projections, etc.

3 2 1 0 13. Recognize various tools utilized in merging data with representation such as Web Feature Service (WFS), XML/GML, OpenGIS, SOAP, etc.

3 2 1 0 14. Explain the implementation of points, polylines, and polygons in representations

and why each is essential to communicate necessary imagery.

3 2 1 0 15. Identify industry standards, standards bodies, consortiums, and reference models in the GIS/Geospatial industry.

3 2 1 0 16. Identify potential legal issues associated with Geospatial information.

# 21055 Aerospace Technology

3 2 1 0 1. Identify various aircraft flight control surfaces and their functions.

3 2 1 0 2. Identify components and explain the functions of aircraft hydraulic system components.

3 2 1 0 3. Identify components and explain the functions of aircraft pneumatic systems.

3 2 1 0 4. Identify components and explain the functions of aircraft electro mechanical systems.

3 2 1 0 5. Describe what conditions would warrant choosing either a hydraulic

3 2 1 0 12. Identify areas of construction on an aircraft where reinforcement would be essential to safety.

3 2 1 0 13. Explain various types of propulsion and their key advantages.

3 2 1 0 14. How does atmosphere and speed affect design of control surfaces?

Explain in context of wing, control surfaces, drag, and transport capacity.

3 2 1 0 15. Explain visual flight conditions vs. instrument flight conditions.

3 2 1 0 16. Identify several types of

instrumentation available in modern aircraft that assist the safety of flight in visual flight and instrument flight.

# 10210 Animation

**Coursework should represent objectives reflective of the locally adopted process. Those listed below are example/foundational.**

### Vector Illustration

Reusing an animation as a motion preset

### Actionscript Animation

3 2 1 0 8. Programming Principles Discussing behaviors & scripting Exploring a scripted application Preparing symbol instances Reading instance property values Storing values by using variables

3 2 1 0 9. Event listeners and event handlers

Implementing continuous motion Controlling speed with a variable Stopping motion when a condition is met

Making a clip move when clicked 3 2 1 0 10. Creating modular code

3 2 1 0 11. Special Classes

Creating a document class Extending the Movie Clip class Associating a custom class with an object

3 2 1 0 12. Using the Debugger

### Interactive Techniques

3 2 1 0 13. Adding audio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | system, a pneumatic system or an | 3 2 1 0 | 1. Creating vector paths | 3 2 1 0 14. Adding a hyperlink | |
| electromechanical system. |  | Creating paths with the pencil tool | 3 2 1 0 | 15. Loading text from an external file |
| 3 2 1 0 | 6. Maintain aircraft flight control surface |  | Creating paths with the pen tool | **Video** |  |
|  | and its associate components. | 3 2 1 0 | 2. Editing vector paths | 3 2 1 0 | 16. Video basics |
| 3 2 1 0 | 7. Identify components and explain the |  | Adjusting anchor points |  | Discussing video encoding |
|  | functions of aircraft fuel systems. |  | Adding and removing anchor points |  | Converting DV content |
| 3 2 1 0 | 8. Identify components and explain the | 3 2 1 0 | 3. Using mask layers | 3 2 1 0 | 17. Embedding video |

functions of aircraft environmental control systems (pressurized and non- pressurized).

3 2 1 0 9. Identify components of various aircraft landing gear systems.

3 2 1 0 10. Perform maintenance and periodic

inspection on aircraft engines.

3 2 1 0 11. Identify potential construction materials and the advantages of using each in aircraft construction.

### Advanced Animation Techniques

3 2 1 0 4. Inverse kinematics

Animating shapes using the Bone tool 3 2 1 0 5. Shape tweens and animated masks

Creating a shape-tween animation Adding shape hints & a mask

3 2 1 0 6. Filter animation

Animating a filter and other effects 3 2 1 0 7. Motion editing

Using the Motion Editor

Importing video

Changing playback component parameters internal to file Creating code to respond to cue points

# 21009 Robotics

3 2 1 0 1. Build or assemble robotic devices or systems.

3 2 1 0 2. Align, fit, or assemble component parts using hand tools, power tools, fixtures, templates, or microscopes.

3 2 1 0 3. Troubleshoot robotic systems using knowledge of microprocessors, programmable controllers, electronics, circuit analysis, mechanics, sensor or feedback systems, hydraulics and pneumatics.

3 2 1 0 4. Train robots using artificial intelligence software to perform simple or complex tasks such as designing and carrying out a series of tests.

3 2 1 0 5. Disassemble and reassemble robots or peripheral equipment to make repairs such as replacement of defective circuit boards, sensors, controllers, encoders, and servomotors.

3 2 1 0 6. Perform corrective maintenance on robotic systems or components.

3 2 1 0 7. Install, program, and repair programmable controllers, robot controllers, end-of-arm tools, or conveyors.

3 2 1 0 8. Read blueprints, schematics, diagrams, or technical orders to determine methods and sequences of assembly.

3 2 1 0 9. Analyze and record test results, and prepare written testing and documentation.

3 2 1 0 10.Explain complex mathematical information used in robotic operations.

3 2 1 0 11. Verify dimensions and clearances

of parts to ensure conformance to

specifications, using precision measuring instruments.

3 2 1 0 12.Debug robotics programs.

3 2 1 0 13.Read and utilize blueprints in the technical process.

3 2 1 0 14.Read and utilize production layouts.

3 2 1 0 15.Read and utilize technical drawings as necessary in robotic assembly and usage.

3 2 1 0 16.Troubleshoot mechanical failures or unexpected problems.

3 2 1 0 17.Integrate robotics with peripherals or other equipment.

3 2 1 0 18.Demonstrate knowledge of how automated robotic systems increase production volume and precision in a variety of high- throughput operations.

3 2 1 0 19.Resolve engineering or science problems using robots.

3 2 1 0 20.Analyze test results in relation to design or rated specifications and test objectives, and modify or adjust equipment to meet specifications.

3 2 1 0 21.Record test procedures and results, numerical and graphical data, and recommendations for changes in product

### APPLICATION LEVEL COURSES

**21112 GIS Spatial Applications**

3 2 1 0 1. Understanding Mapping

1. Discuss the history and societal implications of mapping, GIS, and remote sensing.
2. Identify industry applications for GIS technology.
3. Compare and contrast various forms of maps in terms of purpose, information, and application.
4. Identify sources of GIS information and their applicability to GIS projects.
5. Demonstrate how to read a topographical map
6. Identify terminology associated with map coordinate systems and location
7. Interpret location using the Geographic Coordinate System to identify absolute location
8. Identify terminology associated with maps, map scale, map projections, and orienteering
9. Explain the Universe Transverse Mercator (UTM) coordinate system
10. Interpret locations using the UTM coordinate system
11. Explain how maps are created using aerial photography.
12. Utilize a GPS unit to collect waypoints, measure distance, and calculate area.
13. Demonstrate the use of zooming, identifying, bookmarks, selecting, and panning tools.
14. Explain the components of the map display and the tools in the tool bars of common mapping software.

3 2 1 0 2. Data Usage and Format

1. Explain the need for and uses of metadata.
2. Demonstrate various styles of displaying symbols of data,

sorting querying, and selection techniques

1. Demonstrate editing feature data
2. Explain spatial reference
3. Demonstrate how to georeference an Image Data Layer and add Control Points
4. Demonstrate the ability to define page margins and parameters for printing a specific size
5. Demonstrate effective use of map elements that must be included in a map including title, author, data, legend, scale bar, north arrow
6. Demonstrate effective use of page

space through map scale and frame size

1. Demonstrate process of creating digital archives of maps utilizing the export command
2. Edit Layer Properties.
3. Create Layer Files.
4. Edit an attribute table by adding a new field with calculating values.
5. Perform relates and joins with data tables.
6. Label features.
7. Insert, copy, and paste data into new

3 2 1 0 7. View single band and multispectral images.

3 2 1 0 8. Perform various manipulations to an image including creating a subset of an image, mosaic two georeferenced images, and orthorectification.

3 2 1 0 9. Perform image analysis by orthorectifying non-georeferenced digital images to existing map features.

3 2 1 0 10. Use various tools in image analysis to extract land features from imagery data.

3 2 1 0 11. Categorize land cover types using image analysis tools.

3 2 1 0 12. Conduct vegetation analysis on imagery using image analysis

3 2 1 0 13. Evaluate areas of change in images.

3 2 1 0 14. Enhance an image by adjusting the brightness and contrast, adjusting the histogram, applying custom histogram stretches, sharpening and smoothing its appearance.

3 2 1 0 15. Measure and Interpolation

1. Create a straight line distance calculation.
2. Create a surface from a set of features using the Inverse Distance Weighted interpolation method.
3. Create a surface from a set of features using the Spline interpolation method.

elevation raster.

i. Calculate the viewshed of a surface to determine visible objects.

3 2 1 0 16. Navigate various types of surfaces.

3 2 1 0 17. Explore methods of obtaining, downloading, and extracting free data using the Internet.

3 2 1 0 18. Build 3D datasets.

3 2 1 0 19. Display 2D features onto a 3D surface.

3 2 1 0 20. Create shapefiles to view in a 3D environment.

3 2 1 0 21. Construct a 3D model of an urban environment.

3 2 1 0 22. Display georeferenced data measurements in 3D.

3 2 1 0 23. Apply Interpolation methods.

3 2 1 0 24. Utilize georeferenced 2D data in a 3D environment to provide valuable information.

3 2 1 0 25. Create contour lines in a 3D environment.

# 21011 Civil Engineering

3 2 1 0 1. Students will describe civil engineering and its significance in areas such as community planning, transportation, and sanitation.

3 2 1 0 2. Students will describe the postsecondary and career opportunities in the fields of

3 2 1 0 3. Demonstrate how to analyze land use, population, and flood zone data.

3 2 1 0 4. Create geospatial data.

3 2 1 0 5. Create a geodatabase, import existing feature classes into a geodatabase, and import multiple feature classes to a geodatabase.

3 2 1 0 6. Plan and build a local data inventory.

method.

1. Create elevation contour data from an elevation raster.

|  |  |  |
| --- | --- | --- |
| data frames. d. Create a surf | ace from a set of features | civil engineering. |
| p.Create graphs and reports from data. using the Kriging interpolation 3 2 1 0 | | 3. Students will describe the various |

1. Calculate and display slope derived from an elevation raster.
2. Determine and display aspect from an elevation raster.
3. Create a hillshade surface from an

individuals and agencies and their roles during the design and development of a civil engineering project.

3 2 1 0 4. Students will outline appropriate sequence of action that may include tasks, personnel, and materials to accomplish a civil engineering project and will continually document and modify that

sequence based on personal review and feedback from others as they develop their project.

3 2 1 0 5. Students will identify the criteria and constraints and gather information to promote viable decisions regarding the development of their solutions.

3 2 1 0 6. Students will communicate ideas for designing a development project using various drawing methods, develop two and three dimensional sketches, graphics, or other media (including computer assisted media) collected and documented.

3 2 1 0 7. Students will communicate the current common practices utilized in civil engineering and apply them to develop a viable solution for an engineering project.

3 2 1 0 8. Students will communicate understandings of the relationship of structures and land and the responsibility of designers to handle resources in an ethical manner.

3 2 1 0 9. Students will develop and be able to read a contour map.

3 2 1 0 10. Students will utilize site geography to appropriately place buildings, allow for drainage, provide aesthetic appeal and moderate external climate (utilizing vegetation and landform) and provide for adequate access and parking.

3 2 1 0 11. Students will examine and assess the pros and cons of local, state, and federal regulations on site development.

3 2 1 0 12. Students will research and design an appropriate energy system.

3 2 1 0 13. Students will calculate and determine the heat loss or gain of the energy systems.

3 2 1 0 14. Students will compare and contrast the various elevations views and communicate their understanding of how

elevations are used in the design of the project’s structures.

3 2 1 0 15. Students will identify the regions of the United States that are susceptible to seismic loads.

3 2 1 0 16. Students will research the different types of loads acting on a structure and write a brief description with a diagram in their journals/notebooks.

# 21012 Civil Engineering &

**Architecture**

3 2 1 0 1. Students will compare and contrast civil engineering and architecture.

3 2 1 0 2. Students will describe the postsecondary and career opportunities in the fields of civil engineering and architecture.

3 2 1 0 3. Students will describe the various individuals and agencies and their roles during the design and development of a civil engineering or architectural project.

3 2 1 0 4. Students will outline appropriate sequence of action that may include tasks, personnel, and materials to accomplish a civil engineering or architectural project and will continually document and modify that sequence based on personal review and feedback from others as they develop their project.

3 2 1 0 5. Students will identify the criteria and constraints and gather information to promote viable decisions regarding the development of their solutions.

3 2 1 0 6. Students will communicate ideas for designing a development project using various drawing methods, develop two and three dimensional sketches, graphics, or other media (including computer assisted media) collected and documented.

3 2 1 0 7. Students will communicate the current common practices utilized in civil engineering and architecture and apply them to develop a viable solution for an engineering or architecture project.

3 2 1 0 8. Students will communicate understandings of the relationship of structures and land and the responsibility of designers to handle resources in an ethical manner.

3 2 1 0 9. Students will conduct a survey of their personal residence and write their observations about the locations of the electrical, water, and sewage access points and setbacks.

3 2 1 0 10. Students will develop and be able to read a contour map.

3 2 1 0 11. Students will utilize site geography to appropriately place buildings, allow for drainage, provide aesthetic appeal and moderate external climate (utilizing vegetation and landform) and provide for adequate access and parking.

3 2 1 0 12. Students will examine and assess the pros and cons of local, state, and federal regulations on site development.

3 2 1 0 13. Students will apply their knowledge of architectural styles to the design of the structures.

3 2 1 0 14. Students will apply their knowledge of floor plans to the structures.

3 2 1 0 15. Students will research and design an appropriate energy system.

3 2 1 0 16. Students will calculate and determine the heat loss or gain of the energy systems.

3 2 1 0 17. Students will compare and contrast the various elevations views and communicate their understanding of how elevations are used in the design of the project’s structures.

3 2 1 0 18. Students will draw the exterior and interior elevations.

3 2 1 0 19. Students will compare and contrast sections and details explaining their purposes in a set of architectural plans.

3 2 1 0 20. Students will draw the sections and details complete with appropriate architectural symbols.

3 2 1 0 21. Students will determine and draw appropriate renderings of the mechanical, electrical, and protection systems necessary.

3 2 1 0 22. Students will determine the live and dead loads of a structure using load tables and appropriate mathematics.

3 2 1 0 23. Students will identify the regions of the United States that are susceptible to seismic loads.

3 2 1 0 24. Students will research the different types of loads acting on a structure and write a brief description with a diagram in their journals/notebooks.

3 2 1 0 25. Students will identify roofing materials, types of roof systems, rafters and trusses; calculate the load for roof members; and determine the architectural styles that will support the roof system design chosen for their project.

3 2 1 0 26. Students will determine the strength of columns and beams required for a structure.

3 2 1 0 27. Students will size floor members according to loads and modify section details to show the sizing of supporting materials.

3 2 1 0 28. Students will research the various foundation types, draw sketches of each one, and describe their use.

3 2 1 0 29. Students will prepare a foundation detail.

# 21013 Aerospace Engineering

### History of Flight

3 2 1 0 1. Students will construct a PowerPoint that shows knowledge of the history of flight.

3 2 1 0 2. Students will demonstrate an understanding of the knowledge of aerospace history in a PowerPoint that provides insight to future challenges involving travel through the atmosphere and space.

3 2 1 0 3. Students will list many types of vehicles that have been designed to fly.

3 2 1 0 4. Students shall identify the major components of airplanes which has a specific function in the design and operation of the airplane.

3 2 1 0 5. The forces that act on an aircraft which enable it to fly will be listed by the students.

**Aerodynamics**

3 2 1 0 6. Students will identify the forces applied to an airplane in-flight: lift, weight, drag and thrust.

3 2 1 0 7. Students will explain how wings provide the lifting forces needed to overcome the weight of an airplane.

3 2 1 0 8. Student will demonstrate an understand of power to weight ratio.

3 2 1 0 9. Students will demonstrate basic knowledge of aerodynamics and physics.

3 2 1 0 10. Students will utilize the design process, with computer simulation tools, to predict the performance of a design prior to the building of a physical model.

3 2 1 0 11. Students will utilize the design process to create and evaluate multiple solutions to a problem.

**Airfoil Construction**

3 2 1 0 12. Students design, create, and test prototypes and models of airfoils.

3 2 1 0 13. Students create sub-scale models used to represent a full-size system.

3 2 1 0 14. Students will apply coordinate geometry to create varied shapes used to design an airfoil.

3 2 1 0 15. Students will select appropriate hand tools and equipment, and operate tools and equipment selected to create accurate scale models.

**Wind Tunnel Testing**

3 2 1 0 16. Students will compare and contrast prototypes of auxiliary models.

3 2 1 0 17. Students will use scale models to evaluate, to test, and to determine the performance of aircraft designs.

3 2 1 0 18. Students will use the wind tunnel to graph, display, evaluate and analyze test data.

**Glider Design & Construction**

3 2 1 0 19. The students will use flight theory to design a glider.

3 2 1 0 20. Students predict the flight performance of an aircraft utilizing the mathematics of flight theory.

3 2 1 0 21. Students will construct a multi- component device by the use of assembly and alignment jigs.

3 2 1 0 22. The student will collect and use flight testing data to evaluate an aircraft design.

3 2 1 0 23. Students will construct multiple designs capable of achieving similar results.

Measuring Rocket Engine Thrust

3 2 1 0 24. Parts of a model rocket and parts of a model rocket engine are identified by the student.

3 2 1 0 25. Students understand and explain how the forces of weight, thrust, drag, and lift interact differently on a rocket in flight.

3 2 1 0 26. Students state how Newton's three laws of motions (inertia, F- ma, and action- reaction) can be used to describe and

predict events during each phase of a rocket launch.

3 2 1 0 27. Rockets are designed with features that are interrelated.

3 2 1 0 28. The student will calculate the maximum velocity and maximum acceleration of a rocket during flight.

3 2 1 0 29. The student will calculate a rocket's maximum altitude by using indirect measurement.

Rocket Camera

3 2 1 0 30. The internet and the library are used for conducting research.

3 2 1 0 31. Students understand and explain applications of aerial photography.

3 2 1 0 32. Students use the scientific method to design and project to answer a research question.

3 2 1 0 33. Students formulate a research question based on research, gathering data, analyzing data, and making judgments about experimental data.

3 2 1 0 34. Students use the scale factor of aerial photographs to determine a rocket's altitude, number, and kind of objects in the photograph, and the dimension of objects in the photographs.

3 2 1 0 35. Students use aerial photographs to identify, classify, and enumerate objects in the photograph.

3 2 1 0 36. Students understand that a rocket's launch angle affects the forces of lift, thrust, weight, and drag.

### Orbital Mechanics

3 2 1 0 37. Students create drawings to show that

|  |  |  |
| --- | --- | --- |
| ellipses are conic sections, and circles are |  | ear. |
| special cases of ellipses. | 3 2 1 0 | 47. Students work in cooperative and |

3 2 1 0 38. Students create diagrams to show that orbits involve the steady procession of a

small mass object around a large mass object.

3 2 1 0 39. Students calculate to show that an object in orbit is continuously "falling" toward the body about around which they orbit.

3 2 1 0 40. Students calculate to show that orbital elements can be used to fully define a satellite's orbit, allowing the accurate prediction of the precise location of the satellite at a given time.

### Life Support & Environmental Systems

3 2 1 0 41. Students describe basic physiological needs of the human body when living safely within and outside of Earth's atmosphere.

3 2 1 0 42. The students make a model to show how the environment on earth and in space must be considered when designing solutions to problem in aerospace engineering.

3 2 1 0 43. Students discuss how engineers have solved many technological challenges faced when designing solutions for living higher atmospheres and space.

3 2 1 0 44. Students develop a demonstration of force, mass, and acceleration phenomena or G-forces that astronauts, fighter pilots, and Formula One drivers might experience.

### Effect of gravity on the Human Body

3 2 1 0 45. Students simulate a 1-g, Earth-normal, environment

3 2 1 0 46. Students simulate the action of spinning and how it can fool the senses and stimulate the vestibular system in the inner

supportive teams to simulate how these behaviors result in increased safety and higher quality data.

3 2 1 0 48. Students investigate and give examples of how a stress-filled environment is physically unique and can affect the ability to perform mental functions.

3 2 1 0 49. Students identify common equipment that can be used for data acquisition.

3 2 1 0 50. Students use spreadsheet software to collect, analyze and report data.

### Microgravity Drop Tower

3 2 1 0 51. Students describe gravity and its effects on other masses.

3 2 1 0 52. Students state the value of "g" on earth.

3 2 1 0 53. Students demonstrate microgravity.

3 2 1 0 54. Students describe the microgravity environment associated with the space shuttle.

3 2 1 0 55. Students list the types of experiments that can be done in microgravity.

### Composites Fabrication & Testing

3 2 1 0 56. Students test multiple layers of material to determine that they are stronger than a single layer of that material.

3 2 1 0 57. Students describe the composition of composite materials that are fabricated by molding together layers of reinforced fabric (often glass or carbon fiber) with a plastic matrix, such as epoxy.

3 2 1 0 58. Students describe how composite materials are used in the aerospace industry.

3 2 1 0 59. Students determine how the strength and stiffness of composite materials can be significantly increased.

3 2 1 0 60. The student will assess material performances by comparing strength to weight ratios.

3 2 1 0 61. Students will test composite materials using a deflection test to evaluate the stiffness of various composite plastic samples.

### Thermal Protection Systems for Space Vehicles

3 2 1 0 62. An understanding of the physics of space vehicle re-entry into the atmosphere is used by the students to design thermal protection systems.

3 2 1 0 63. Students demonstrate knowledge of material properties and types of testing when trying to protect a space vehicle.

3 2 1 0 64. Students describe the heat transfer process that creates high temperatures in a space vehicle.

3 2 1 0 65. Thermal Protection Systems (TPS) are described by the students.

### Intelligent Vehicles

3 2 1 0 66. Students will evaluate incentives for building robots.

3 2 1 0 67. Students define interactive systems used in science exploration.

3 2 1 0 68. Students will interpret electronic data and communication that allows information to be transferred from human to human, human to machine, machine to human, and machine-to-machine.

3 2 1 0 69. Students will define the meaning of pH values.

3 2 1 0 70. Students will describe uses for robotic devices.

3 2 1 0 71. Students will list robotic devices that are composed of mechanical, electrical, and computer based systems that can be programmed to make decisions and control actions based upon sensor readings.

3 2 1 0 72. Students will construct a robot device that performs a task.

# 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.

1. Plan for products/services using reliability factors.
2. Demonstrate knowledge of the key functions and subsystems of the product.
3. Demonstrate knowledge of cross- functional team structures and team members’ roles.
4. Create/evaluate products/services using reliability factors.
5. 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).

# 21053 Emerging Technologies

Coursework should represent objectives reflective of the locally adopted process. Those listed below are example/foundational only.

|  |  |  |
| --- | --- | --- |
| 3 2 1 0  3 2 1 0 | 1.  2. | Demonstrate the research skills necessary to identify and evaluate emerging technologies  Seek and identify sources of |
|  |  | information on new technology. |
| 3 2 1 0 | 3. | Identify solutions and problems that |
|  |  | go beyond the expected and |
| 3 2 1 0 | 4. | obvious.  Identify sciences and technology |
|  |  | areas most impacted and with most |
|  |  | potential to utilize the new |
| 3 2 1 0 | 5. | technologies.  Be able to explain why it is |
|  |  | important for STEM professionals |
|  |  | to keep abreast of evolving |
| 3 2 1 0 | 6. | technologies.  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. |

g. industry and education

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 9. | Develop a plan for anticipating change. | 3 2 1 0 | 2. Employ customer service principles when working | 3 2 1 0 | 10. | Design potential timelines for assignments. |
| 3 2 1 0 | 10. | Address each of the following areas |  | with consumers. | 3 2 1 0 | 11. | Explore appropriate technologies |
|  |  | to varying degrees based on | 3 2 1 0 | 3. Evaluate and follow-up on customer |  |  | for project management and |
|  |  | available information: |  | service provided. |  |  | resource scheduling. |
|  |  | a.anticipated employment, | 3 2 1 0 | 4. Employ safety skills and equipment | 3 2 1 0 | 12. | Create and present a project |
|  |  | 1. drivers and constraints, 2. size and location of market, | 3 2 1 0 | usage in appropriate ways.  5. Be aware of MSDS (Material |  |  | management and resource  scheduling plan. |
| d.connection(s) to existing Safety Data Sheets) and other 3 2 1 0 | | | | | | 13. | Create Gantt charts. |
| technologies, safety resources and employ 3 2 1 0 | | | | | | 14. | Evaluate and assign resources to |
| e.ability and ease of replication, those resources as required for | | | | | |  | tasks. |
| f. physical and capital costs, the workplace. 3 2 1 0 | | | | | | 15. | Implement project management |
|  | | | | | |  | skills to design and complete a |
|  | | | | | |  | collaborative project. |
| partnerships to be leveraged,  h.national best practices, **21205 Project Management and** 3 2 1 0 | | | | | | 16. | Learn various survey strategies to |
|  | | | | | |  | track project progress. |
| 3 2 1 0 | | | | | | 17. | Develop strategies for monitoring |
| recommendations, aims and | | | | | |  | interconnected assignments. |
| approaches for the 3 2 1 0 1. Recognize different resource types 3 2 1 0 | | | | | | 18. | Survey strategies for critical path |
|  | | | | | |  | scheduling. |
| j. Innovation system modeling Personnel/Skills, Generic, etc) 3 2 1 0 | | | | | | 19. | Create strategies to manage project |
| k. Technology monitoring, 3 2 1 0 2. Understand the concept of scope  forecasting and assessment and demonstrate in context of 3 2 1 0 | | | | | |  | budgets. |

i. illustrate qualifications, and

# Resource Scheduling

Technological innovation

(Work, Material, Cost, Budget,

1. Trend analysis methods & scenarios
2. Impact assessment

## n o p q

|  |  |  |  |
| --- | --- | --- | --- |
| .Risk analysis  .Action (policy) analysis  .Technology road mapping  .Communication and | 3 2 1 0 | 4. | Identify key personnel and  responsibilities for project. |
| 3 2 1 0 | 5. | Develop SWOT analysis [Strengths, |
|  |  | Weaknesses, Opportunities, and |
| implementation of innovation  forecasts | 3 2 1 0 | 6. | Threats] for project.  Analyze workload of tasks and |
|  |  |  | projects. |
|  | 3 2 1 0 | 7. | Determine required personnel |

assessing the size of a project.

3 2 1 0 3. Develop plans for project

management and resource scheduling.

20. Build survey analysis for customer satisfaction.

# 21048 Workplace Experience

3 2 1 0 1. Employ effective listening skills

when working with client.

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.