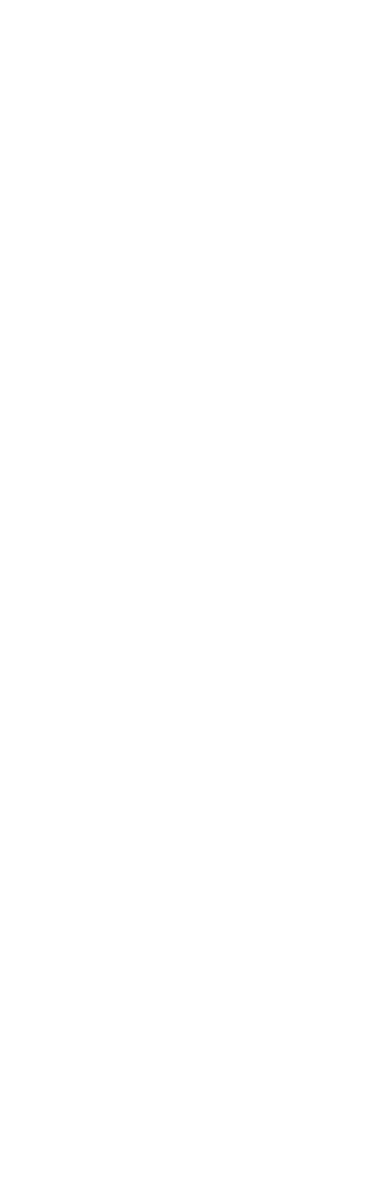
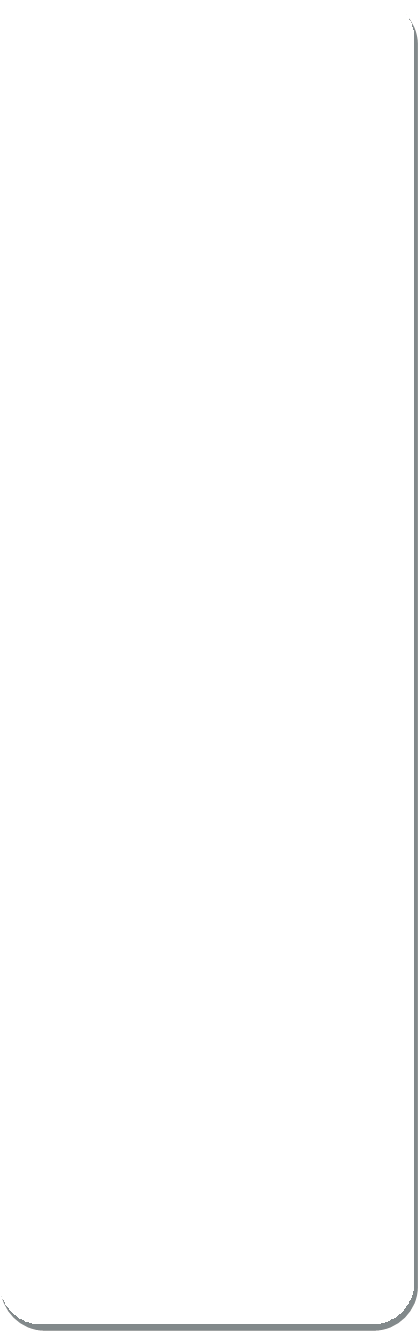
**ENGINEERING CAREER CLUSTER DESIGN**



**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.

Engineering & Applied Mathematics Pathway – CIP Code 14.0101

***INTRODUCTORY LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [Principles of Tech. (8-9)](#_bookmark0) | [53153/03153](#_bookmark0) | 1 credit | [Pre-Engineering Tech. (8-9)](#_bookmark1) | [21001/7100](#_bookmark1)1 | 1 credit |
| [Computing Systems (8-9)](#_bookmark5) | [10002/60002](#_bookmark5) | 1 credit | * [Engineering Appl. (8-9)](#_bookmark2) | [21002/71002](#_bookmark2) | 1 credit |
| [Computer Appl. (8-9)](#_bookmark4) | [10004/60004](#_bookmark4) | 1 credit | [Engineering Tech. (8-9)](#_bookmark3) | [21003/71003](#_bookmark3) | 1 credit |
| [Blueprint Reading](#_bookmark6) | [21108](#_bookmark6) | .5 credit |  |  |  |

***TECHNICAL LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [Prin. Of Engineering](#_bookmark6) | [21004](#_bookmark6) | 1 credit | [Engineering-Comprehensive](#_bookmark9) | [21005](#_bookmark9) | 1 credit |
| [Engineering Design](#_bookmark7) | [21006](#_bookmark7) | 1 credit | [Foundations of Electronics](#_bookmark10) | [21201](#_bookmark10) | 1 credit |
| [Robotics](#_bookmark8) | [21009](#_bookmark8) | 1 credit |  |  |  |
| [Advanced Production](#_bookmark9) |  |  | [Technical Innovation](#_bookmark11) |  |  |
| [Blueprint Reading](#_bookmark9) | [39108](#_bookmark9) | .5 credit | [and Assessment](#_bookmark11) | [21054](#_bookmark11) | 1 credit |

[Course appropriate for](#_bookmark12) Project Lead the Way Programs;

***APPLICATION LEVEL***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| [Emerging Technologies](#_bookmark12) | [21053](#_bookmark12) | 1 credit | [Materials Science & Engineering](#_bookmark13) | [21252](#_bookmark13) | 1 credit |
| [Digital Electronics](#_bookmark12) | [21008](#_bookmark12) | 1 credit | [Civil Eng. & Architecture or](#_bookmark18) | [21012](#_bookmark18) | 1 credit |
| [Computer Integrated](#_bookmark17) |  |  | [Civil Engineering](#_bookmark19) | [21011](#_bookmark19) | 1 credit |
| [Manufacturing](#_bookmark17) | [21010](#_bookmark17) | 1 credit | [Aerospace Engineering](#_bookmark20) | [21013](#_bookmark20) | 1 credit |
| [BioEngineering or](#_bookmark17) | [21020](#_bookmark17) | 1 credit | [Particular Topics in Engineering](#_bookmark14) | [21015](#_bookmark14) | 1 credit |
| [Biotechnical Engineering](#_bookmark17) | [21014](#_bookmark17) | 1 credit | [Eng. Design & Development](#_bookmark15) | [21007](#_bookmark15) | 1 credit |
| [Project Mgmt & Resource](#_bookmark16)  [Scheduling](#_bookmark16) | [21205](#_bookmark16) | 1 credit | [Workplace Experience](#_bookmark13) | [21048](#_bookmark13) | 1 credit |

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**

ENGINEERING & APPLIED MATHEMATICS PATHWAY (C.I.P. 14.0101)

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.

3 2 1 0 12. Students will work collaboratively with team members to complete an engineering project.

# 21001 Pre-Engineering Technology

## St C

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **udents will:**  **ommunication and interpretation of information n industry-standard formats:** | | | 3 2 1 0 | 10. | Analyze relationships between  voltage, current, resistance, and power related to direct current (DC) | 3 2 1 0 21. | their applications.  Know how energy is transferred; know the effects of resistance in |
|  |  | circuits. |  | mechanical, electrical, fluid, and |
| 3 2 1 0 | 1. | Understand the classification and | 3 2 1 0 | 11. | Understand the characteristics of |  | thermal systems. |
|  |  | use of various components, |  |  | alternating current (AC) and how it | 3 2 1 0 22. | Solve problems by using the |
|  |  | symbols, abbreviations, and media common to electronic and mechanical drawings. |  |  | 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**

waveforms may be used to carry energy.

3 2 1 0 9. Understand how electric and

magnetic phenomena are related and know common practical applications.

## Fundamentals of electrical energy:

**and resistance in mechanical, electrical, fluid, and thermal engineering systems:**

3 2 1 0 18. Understand scalars and vectors.

3 2 1 0 19. Solve problems by using the

concept of vectoring to predict the resultant forces.

3 2 1 0 20. Know the six simple machines and

3 2 1 0 2. Understand, organize, and

complete an assembly drawing by

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

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

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

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

measurements and calculations of voltage, current, resistance, and

mathematical statements when appropriate.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 6. | Understand Newton’s laws and how  they affect and define the | 3 2 1 0 | 15. | power.  Classify and use various electrical | 3 2 1 0 27. | Develop a solution from multiple  details provided by client. |
|  | movement of objects. |  |  | components, symbols, | 3 2 1 0 28. | Build a prototype from plans and |
| 3 2 1 0 7. | Understand how the laws of conservation of energy and momentum provide a way to | 3 2 1 0 | 16. | abbreviations, media, and  standards of electrical drawings. Understand how electrical control | 3 2 1 0 29. | test it.  Evaluate and redesign a prototype on the basis of collected test data. |

predict and describe the movement of objects.

3 2 1 0 8. Analyze the fundamentals and

properties of waveforms and how

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,

**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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 31. | cycle.  Understand the major |  | | display data in a simulated or modeled automated system. | 3 2 1 0 | 5. | Assemble an engineering notebook and a portfolio. |
|  | manufacturing processes. | 3 2 1 0 43. | | Understand the use of sensors for | 3 2 1 0 | 6. | Describe the design process and |
| 3 2 1 0 32. | Use tools, fasteners, and joining |  | | data collection and process |  |  | 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 |  | | process. | 3 2 1 0 | 8. | Recognize design criteria and |
|  | International and United States | 3 2 1 0 45. | | Use motors, solenoids, and similar |  |  | 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 | 3 2 1 0 46. | | Assemble input, processing, and | 3 2 1 0 | 10. | Explain a design brief and apply the |
|  | and instruments. |  | | output devices to create an |  |  | 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 | preprogrammed task. | | |  |  | and apply this concept to the design |
|  | interact with hardware. | **Fundamentals of systems and products in phases** | | |  |  | 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. | |  | | development. | 3 2 1 0 | 13. | Demonstrate the ability to measure |
| 3 2 1 0 37. Install and configure computer | | 3 2 1 0 48. | | Understand project management, |  |  | 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** | **Eng** | **ineering Applications** |  |  | sketching as a communication tool. |
| equipment and systems. | |  |  |  | 3 2 1 0 | 17. | Use visualization, spatial reasoning, |
| 3 2 1 0 40. Test and maintain wireless and **Design and Modeling** and geometric shapes to sketch two  wired communications components 3 2 1 0 1. Explain the relationship between and three dimensional shapes. | | | | | | | |

and systems.

3 2 1 0 41. Use utility software efficiently to

diagnose and correct problems. **Students understand fundamental automation modules and are able to develop systems that complete preprogrammed tasks:**

3 2 1 0 42. Use appropriate tools and

technology to perform tests, collect data, analyze relationships, and

science, technology, engineering and math.

3 2 1 0 2. Describe engineering and explain how engineers participate in or contribute to the invention and innovation of products.

3 2 1 0 3. Describe impacts that technology has had on society.

3 2 1 0 4. Distinguish between invention and innovation.

3 2 1 0 18. Recognize and create thumbnail, perspective, isometric, and orthographic sketches.

3 2 1 0 19. Recognize and accurately interpret one and two point perspective drawings.

3 2 1 0 20. Communicate ideas for a design using various sketching

methods, notes, and drafting views.

## 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 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)

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

# 21003 Engineering Technology

## Flight and Space

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 | 1. | Apply their knowledge of research |
|  |  | techniques to investigate the |
|  |  | history of an aerospace vehicle. |
| 3 2 1 0 | 2. | Experience the flight |
|  |  | characteristics of kites, whirly gigs,  model airplanes, hot air balloons, |
|  |  | and model rockets. |

3 2 1 0 3. Utilize language arts skills to write a script and create a storyboard for an infomercial promotion of an aerospace vehicle.

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 29. Create a decision-making matrix.  3 2 1 0 30. Select an approach that meets or | 3 2 1 0 41. | Differentiate between potential and  kinetic energy. |
| satisfies the constraints given in a  design brief. | 3 2 1 0 42. | Explain the differences, advantages,  and disadvantages between |
|  |  | exhaustible, inexhaustible, |
| **Automation and Robotics** |  | renewable, and non-renewable |
| 3 2 1 0 31. Describe the purpose of automation |  | energy sources. |

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.

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

* Efficiency vs. Conservation and measures to address each

3 2 1 0 4. Distinguish between the forces of lift, drag, weight, and thrust that affect an object moving through a fluid. Understand the importance of each force.

3 2 1 0 5. Examine how center of gravity

affects an aerospace vehicle in distributing weight.

3 2 1 0 6. Discover how Newton’s laws apply to flight and space.

3 2 1 0 7. Discover Bernoulli’s principle

through exploration.

3 2 1 0 8. Recognize the tools and purpose of aeronautic design and testing.

3 2 1 0 9. Identify the characteristics of an airfoil and how they compare and contrast with the characteristics of wings.

3 2 1 0 10. Analyze the features and benefits of different types of wings.

3 2 1 0 11. Describe the major parts (fuselage, empennage, high lift devices, wings, undercarriage, propulsion, instruments, and controls) of

## Science of Technology

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 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 | 36. | Analyze a product through testing |

3 2 1 0 20. Describe the difference between a chemist and a chemical engineer.

3 2 1 0 21. Apply science and engineering skills to make ice cream.

3 2 1 0 22. Follow the design process to create

methods and make modifications to the product.

## Magic of Electrons

3 2 1 0 37. Identify the roles of protons,

neutrons, and electrons in an atom. Identify an element based on the atomic number.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 12. | aircraft and how they can affect an adhesive. 3 2 1 0 38.  the overall balance of an airplane 3 2 1 0 23. Work with a team to solve an oil  spill engineering simulation 3 2 1 0 39.  during flight. problem.  Research and design an airfoil and 3 2 1 0 24. Demonstrate an understanding of 3 2 1 0 40. | | | | | |
|  |  | empennage for use in the  prototyping of a Styrofoam glider. | 3 2 1 0 | 25. | how small a nanometer is. Explore how nano-products are |  |  |
| 3 2 1 0  3 2 1 0 | 13.  14. | Explore the history and  development of rocketry, space flight, and living in space.  Discover the basic principles of | 3 2 1 0 | 26. | used in society today.  Identify tools and processes used to see and manipulate matter at the nanoscale. | 3 2 1 0 | 41. |
| 3 2 1 0 | 15. | flight and rocketry.  Investigate how changes in various | 3 2 1 0 | 27. | Discuss the impact that nanotechnology has on their lives | 3 2 1 0 | 42. |
|  |  | design characteristics of a rocket |  |  | today and will have in the future. |  |  |

Identify metals, metalloids, and non-metals on the periodic table. Judge whether a material is a

conductor, insulator, or semiconductor based upon its number of valance electrons and its position on the periodic table.

Explain how the Law of Charges holds an atom together.

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.
3. Send email messages.
4. Access email attachments.
5. Attach documents to messages.
6. Demonstrate knowledge of contamination protection strategies for email.
7. Save email messages / attachments. 3 2 1 0 2. Research and Internet
8. 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

justification, etc.

1. Enhance publications using paint/draw functions.
2. Format new desktop publishing files.
3. Output desktop publishing files.
4. Place graphics in document.
5. Prepare publications using desktop publishing software.
6. Use advanced formatting features (e.g., headers/footers/dropped caps, and indexing).
7. Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication.
8. Edit presentations.
9. Insert graphic elements (e.g., graph, clip art, table) in a slide.
10. Identify hardware items that support presentation software (e.g., scanners, digital cameras, printers, and projection systems).
11. Print a single slide, an entire presentation, an outline, and notes.

3 2 1 0 5. Data

* 1. Enter data using a form.
  2. Locate/replace data using search and replace functions.
  3. Process data using database functions (e.g., structure, format, attributes, relationships, keys).
  4. Perform single- and multiple-table queries (e.g., create, run, save).
  5. Print forms, reports, and results or queries.
  6. Search a database table to locate records.
  7. Sort data using single and multiple field sorts.
  8. Verify accuracy of output.
  9. Maintain shared database of contact information.
  10. Manage daily/weekly/monthly schedule using applications.
  11. Participate in virtual group discussions and meetings.
  12. Apply basic commands of operating system software.
  13. Employ desktop operating skills.

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| --- | --- | --- | --- | --- | --- |
| a. | Create documents (e.g., letters,  memos, reports) using existing | s. | Run slide shows manually and  automatically. | n. | Apply appropriate file and  disk management |
| forms and templates. 3 2 1 0 4. Spreadsheets techniques. | | | | | |
| b. | Employ word processing utility  tools (e.g., spell checker, | a.  b. | Create spreadsheets.  Edit spreadsheets. | o. | Recognize the need for regular  backup procedures. |
|  | grammar checker, thesaurus). | c. | Print spreadsheets. | p. | Demonstrate knowledge of |
| c. | Format text using basic formatting | d. | Retrieve existing spreadsheets. |  | central processing unit (CPU) |
| d. | functions.  Retrieve existing documents. | e.  f. | Save spreadsheets.  Create charts and graphs from | q. | control and architecture.  Identify CPU modes of operations. |
| e. | Safeguard documents using name & |  | spreadsheets. | r. | Define the role of memory |
|  | save functions. | g. | Group worksheets. |  | management in an operating system. |
| f. | Create new word processing forms,  style sheets, and templates. | h. | Input/process data using  spreadsheet functions. | s. | Demonstrate knowledge of network  operating systems. |
| g. | Enhance publications using | i. | Perform calculations using simple | t. | Demonstrate knowledge of |

different fonts, styles, attributes,

formulas.

operating system architecture types.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| u. | Demonstrate knowledge of the commands used to handle tasks in |  | q. | company standards.  Identify the features and benefits of | **f.** | Run applications. jobs in accordance with processing |
|  | operating systems. |  |  | quality planning. |  | procedures. |
| v. | Differentiate between  microcomputer, minicomputer, and mainframe operating systems. | 3 2 1 0 | r.  7. | Identify the role of quality within the  organization.  History / Quality Assurance | g.  h. | Follow log-off and power-down  procedure(s).  Handle materials and |

1. Demonstrate knowledge of the basics of process management.
2. Demonstrate knowledge of the system utilities used for file management.
3. Demonstrate knowledge of changes brought about by quality industry leaders in the world.
4. Demonstrate knowledge of successful efforts by industry

equipment in a responsible manner.

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

1. Document step-by-step installation and configuration

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| 3 2 1 0 | 6. Ethics and Security  a. Demonstrate knowledge of potential internal and external | c. | to improve quality and/or  reduce costs.  Demonstrate knowledge of the | 3 2 1 0 | procedures.  3. Communicate and recognize goal achievement. |
|  | threats to security. |  | historical evolution of quality |  | a. Communicate goal achievement. |
|  | b. Assess exposure to security issues. |  | assurance/total quality |  | b. Provide recognition for goal |
|  | c. Demonstrate knowledge of virus |  | management (e.g., Deming, ISO |  | achievement. |
|  | protection strategy.  d. Ensure compliance with security | d. | 9000).  Demonstrate knowledge of the | 3 2 1 0 | 4. Configure systems to provide optimal  system interfaces. |
|  | rules, regulations, and codes. |  | standards/requirements for the |  | a. Apply concepts of privileged |
|  | e. Explore ways to implement |  | Baldridge award. |  | instructions and protected mode |
|  | countermeasures.  f. Implement security procedures | e. | Demonstrate knowledge of quality  management terminology. |  | programming.  b. Configure peripheral device drivers |
|  | in accordance with business |  |  |  | (e.g., disk, display, printer, modem, |
|  | ethics. |  |  |  | keyboard, mouse, network). |

1. Maximize threat reduction.
2. Document security procedures.
3. Understand how to follow a disaster plan.
4. Identify sources of virus infections.

# 10002 Computing Systems

3 2 1 0 1. Apply knowledge of operating

systems principles to ensure

1. Allocate disk space, non-sharable resources, and I/O devices.
2. Interface peripheral devices/controllers in the computer system (e.g., software

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| k.  l.  m. | 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 | e. | and hardware interrupts,  exceptions, Direct Memory Addressing [DMA], bus structures). Identify standards and issues related to I/O programming and design of I/O interfaces. |
| n. | Understand how to provide for |  | management techniques. | f. | Define hardware-software interface |
| o. | user authentication (e.g., assign passwords, access level).  Understand how to remove viruses. | **d.**  **e.** | Employ desktop operating skills.  Follow power-up and log-on procedures. | g. | issues for a computer system. Apply advanced I/O concepts (e.g., disk caching, data compression, |
| p. | Report viruses in compliance with |  |  |  | extended memory, magnetic |

disk/CD-ROM storage and formats).

3 2 1 0 5. Configure/modify system as

needed.

1. Build system software command structures using operating system macro facilities for computer systems.
2. Identify scheduling priority in programming.
3. Identify data requirements.
4. Review automated scheduling software.
5. Secure needed supplies and resources.

development, and risk management for information system.

1. Demonstrate knowledge of critical thinking skills and techniques.
2. Demonstrate knowledge of decision-making skills and techniques.
3. Develop a plan using data- oriented techniques.
4. Determine whether prototyping system is feasible.

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 6. | Determine audience and | h. | Determine software design | local and wide area networks. |
|  |  | information needs |  | process, from specification to | a. Distinguish between local area |

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,

implementation.

* 1. Appraise software process and product life-cycle models.

j. 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

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).

1. Demonstrate knowledge of the key functions of systems software.

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

1. Identify the role the binary system in information systems.
2. Demonstrate knowledge of number systems and internal data representation.

3 2 1 0 21. Gather information.

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. Identify the hardware associated with telecommunications functions.
3. Identify major hardware components and their functions.
4. Identify the three main classifications of computers (i.e. micro-, mid-range, & mainframe).

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

& to future knowledge worker productivity.

1. Identify new & emerging drivers and inhibitors of information technology change.

3 2 1 0 24. Monitor and adjust goals.

1. Obtain support for goals.
2. Provide support for goals.
3. Monitor goal achievement.
4. 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 resources as needed.

1. Select appropriate installation options (e.g., default, customized).
2. Configure software to appropriate operating system settings.
3. Configure macros, tools, and

organizational and personal tasks.

1. Differentiate between procedures for an upgrade and for a new installation.
2. Differentiate between stand-alone and network installation procedures.
3. Disable/uninstall software that may interfere with installation of new software.
4. Install given application/system software on various platforms in accordance with manufacturer's procedures.
5. Convert data files if required.
6. 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 procedures.

3 2 1 0 30. Troubleshoot computer-driven

equipment and machines and access support as needed

1. Test system using diagnostic tools/software.
2. Repair/replace malfunctioning hardware.
3. Reinstall software as needed.
4. Recover data and/or files.
5. Restore system to normal operating

3 2 1 0 23. Identify new IT technologies and

packages to accomplish simple

3 2 1 0 31.

standards.

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.
4. Assess how color affects the principles of line, value, shape and form.
5. 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).

# 21108 Production Blueprint Reading

(.5 Credit) An introductory level course to provide students with the knowledge and ability to interpret the lines, symbols, and conventions of blueprints from a variety of industrial applications.

3 2 1 0 1. Identify symbols associated with

blueprints

3 2 1 0 2. Interpret work from multiview

drawings

3 2 1 0 3. Interpret size and location of

features

3 2 1 0 4. Visualizing shapes and objects in

multiple views

3 2 1 0 5. Ability to convert fractions and

decimals proficiently

3 2 1 0 6. Interpret inch and metric drawings

3 2 1 0 7. Demonstrate legend and note

reading skills

3 2 1 0 8. Interpret basic geometric

dimensioning and tolerancing terminology

3 2 1 0 9. Identify different views utilized in blueprint reading

3 2 1 0 10. Identify orthographic projection

such as lines and symbols for electrical, piping, mechanical, architectural, welding, and machining prints

## TECHNICAL LEVEL COURSES

**21004 Principles of Engineering**

3 2 1 0 1. Students will have an understanding

of engineering and be able to identify engineering achievements through history.

3 2 1 0 2. Students will be able to define

attributes associated with being a successful engineer.

3 2 1 0 3. Understand that an engineering

team must work together to solve problems, with each team member having individual and collective responsibilities.

3 2 1 0 4. Understand how gender-bias, racial-

bias and other forms of stereotyping and discrimination can adversely affect communications within an engineering team.

3 2 1 0 5. Understand how ethics influences

the engineering process. 3 2 1 0 6. Understand how social,

environmental and financial constraints influence the engineering process.

3 2 1 0 7. Students will have an understanding

of the difference between engineering disciplines and job functions.

3 2 1 0 8. Students will research and discover

the educational requirements to become an engineer.

3 2 1 0 9. Students will become familiar with

an area of engineering by preparing for and conducting an interview with an engineer in that field of engineering.

3 2 1 0 10. Students will compose sketches

using proper sketching techniques in the solution of design problems.

3 2 1 0 11. Students will select the appropriate

sketching styles for presentation of a design problem to a group.

3 2 1 0 12. Students will plan and compose a

written technical report about the research they conducted about a career field in engineering.

3 2 1 0 13. Students will be able to formulate

an organized outline for a technical paper.

3 2 1 0 14. Students will be able to design and

create tables, charts, and graphs to illustrate data they have collected.

3 2 1 0 15. Students will evaluate and select

appropriate type of table, chart, or graph to accurately communicate collected data for written work or presentations.

3 2 1 0 16. Students will design and deliver a

presentation utilizing appropriate support materials about research they have conducted.

3 2 1 0 17. Students will trace the history of an

invention and evaluate its effects on society and the environment.

3 2 1 0 18. Students will examine the evolution

of an invention to observe and report on how the design process is applied to continuously redesign and improve the product.

3 2 1 0 19. Students will mathematically explain the mechanical advantage gained and explain the function of the six different types of simple machines.

3 2 1 0 20. Students will apply simple machines

to create mechanical systems in solution of a design problem.

3 2 1 0 21. Students will design, diagram and

implement a program to control a device they construct to perform a sorting operation.

3 2 1 0 22. Students will select and apply

concepts of mechanical, electrical, and control systems in solving design problems.

3 2 1 0 23. Students will formulate a plan for

evaluating the functioning of their sorting device and to make

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|  | | appropriate changes in design, circuitry or programming. | 3 2 1 0 | 34. | Students will be able to identify practical applications of each |  |  | destructive material testing and will be able to use the data collected |
| 3 2 1 0 | 24. | Students will mathematically |  |  | material category to engineered |  |  | through these tests to compute and |
|  |  | analyze a simple truss to determine |  |  | products and processes. |  |  | document mechanical properties. |
|  |  | types and magnitude of forces | 3 2 1 0 | 35. | Students will be able to identify and | 3 2 1 0 | 46. | Students will be able to analyze a |
| 3 2 1 0 | 25. | supported in the truss.  Students will be able to define, |  |  | document the properties of  materials. |  |  | product that breaks and be able to  explain how the material failed. |
|  |  | describe, and analyze the stresses | 3 2 1 0 | 36. | Students will be able to design an | 3 2 1 0 | 47. | Students will be able to diagram a |
|  |  | and forces acting on an object. |  |  | experiment to identify an unknown |  |  | system and identify the critical |
| 3 2 1 0 | 26. | Students will prepare and present a  mathematical analysis of a truss | 3 2 1 0 | 37. | material.  the student will be able to formulate | 3 2 1 0 | 48. | components.  Students will be able to |
|  |  | design as part of a 5- minute oral |  |  | conclusions through analysis of |  |  | mathematically estimate chance of |
|  |  | presentation about their bridge |  |  | recorded laboratory test data for |  |  | failure of a system given information |
| 3 2 1 0 | 27. | design.  Students will explain the use of |  |  | presentations in the form of charts,  graphs, written, verbal, and multi- | 3 2 1 0 | 49. | on certain components.  Students will list the causes of |
|  |  | factors of safety in the design |  |  | media formats. |  |  | failure and be able to propose |
|  |  | process. | 3 2 1 0 | 38. | Students will be able to analyze |  |  | solutions. |
| 3 2 1 0 | 28. | Students will be able to explain the  difference between the area of a |  |  | word problems about forces acting  on materials. | 3 2 1 0 | 50. | Students will prepare and defend a  position on an ethical engineering |
|  |  | cross section of an object and the | 3 2 1 0 | 39 | Students will be able to define and |  |  | dilemma. |
|  |  | second moment of the area |  |  | state examples of the major | 3 2 1 0 | 51. | Students will analyze an engineering |
|  |  | (Moment of Inertia) and predict the  relative strength of one shape vs. | 3 2 1 0 | 40. | categories of Production Processes.  Students will be able to interpret a |  |  | failure for the purpose of presenting  an oral report which identifies |
|  |  | another. |  |  | drawing and produce a part. |  |  | causes, damage done, design |
| 3 2 1 0 | 29. | Students will be able to use a | 3 2 1 0 | 41. | Students will be able to state the |  |  | failures, and other areas where the |
|  |  | computer aided engineering  package to analyze a shape. |  |  | difference between mass and  weight. |  |  | failure has impacted the  environment or society. |
| 3 2 1 0 | 30. | Students will explain the effects that | 3 2 1 0 | 42. | Students will be able to utilize a | 3 2 1 0 | 52. | Students will prepare a written |
|  |  | stress has on a material and explain |  |  | variety of precision measurement |  |  | report explaining their analysis of an |
| 3 2 1 0 | 31. | how the material will react.  Students will be able to identify and |  |  | tools to measure appropriate  dimensions, mass, and weight. | 3 2 1 0 | 53. | engineering failure.  Students will be able to explain the |
|  |  | differentiate the five basic | 3 2 1 0 | 43. | Students will be able to calculate |  |  | difference between distance |
|  |  | categories of solid engineering |  |  | the mean, median, mode and |  |  | traveled and displacement |
| 3 2 1 0 | 32. | materials.  Students will be able to compare |  |  | standard deviation for a set of data  and apply that information to an | 3 2 1 0 | 54. | Students will design and build a  device for the purpose of |
|  |  | and contrast the physical properties |  |  | understanding of quality assurance. |  |  | conducting experiments of |
|  |  | of organic, metals, polymers, | 3 2 1 0 | 44. | Students will be able to explain the |  |  | acceleration, displacement, and |
| 3 2 1 0 | 33. | ceramics, and composites.  Students will be able to trace the |  |  | difference between process and  product control. | 3 2 1 0 | 55. | velocity.  Students will be able to explain how |
|  |  | production of raw material to | 3 2 1 0 | 45. | Students will be able to describe and |  |  | velocity and acceleration are |
|  |  | finished product. |  |  | safely conduct destructive and non- |  |  | calculated. |

# 21006 Engineering Design

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| --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 56. | Students will be able to calculate range and initial acceleration from |  |  | and explain the function of the six different types of simple machines. |
|  |  | data they record from experiments. | 3 2 1 0 | 71. | Students will design, diagram, and |
| 3 2 1 0 | 57. | Students will be able to analyze test |  |  | implement a program to control a |
|  |  | data and utilize the results to make |  |  | device they construct to perform a |
| 3 2 1 0 | 58. | decisions.  Listen for and identify key words | 3 2 1 0 | 72. | sorting operation.  Students will mathematically |
| 3 2 1 0 | 59. | Listen for words that identify a |  |  | analyze a simple truss to determine |
|  |  | procedure |  |  | types and magnitude of forces |
| 3 2 1 0 | 60. | Listen for steps or actions to be  performed | 3 2 1 0 | 73. | supported in the truss.  Students will prepare and present a |
| 3 2 1 0 | 61. | Listen for clues regarding the order |  |  | mathematical analysis of a truss |
|  |  | or sequence in which a task is |  |  | design as part of a 5- minute oral |
| 3 2 1 0 | 62. | performed.  Students will be able to define and |  |  | presentation about their bridge  design. |
|  |  | understand the importance of needs | 3 2 1 0 | 74. | Students will be able to use a |
|  |  | and wants, values, goals, and |  |  | computer-aided engineering |
| 3 2 1 0 | 63. | standards  Locate information and select the | 3 2 1 0 | 75. | package to analyze a shape  Students will be able to |
|  |  | materials, tools, equipment, or |  |  | mathematically estimate chance of |
|  |  | other resources to perform the |  |  | failure of a system given information |
|  |  | activities needed to accomplish a  specific task | 3 2 1 0 | 76. | on certain components.  Students will be able to explain the |
| 3 2 1 0  3 2 1 0 | 64.  65. | Develop strategies to overcome  procrastination and meet deadlines. Access and use information to | 3 2 1 0 | 77. | difference between distance  traveled and displacement. Students will be able to explain how |
| 3 2 1 0 | 66. | develop educational and career  options.  Value diversity, practice tolerance | 3 2 1 0 | 78. | velocity and acceleration are  calculated.  Students will be able to calculate |
| 3 2 1 0 | 67. | and acceptance, and work  cooperatively toward common goals Apply one or more problem-solving | 3 2 1 0 | 79. | range and initial acceleration from  data they record from experiments Students will identify and |
| 3 2 1 0 | 68. | processes to a given situation(s)  Students will compose sketches |  |  | demonstrate the use of common  dimensioning |
| 3 2 1 0 | 69. | using proper sketching techniques in  the solution of design problems Students will be able to design and | 3 2 1 0 | 80. | Students will interpret data, which  has been statically analyzed, to ensure product quality |
| 3 2 1 0 | 70. | create tables, charts, and graphs to  illustrate data they have collected. Students will mathematically explain | 3 2 1 0 | 81. | Students will formulate a product  cost analysis for given product. |
|  |  | the mechanical advantage gained |  |  |  |

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| 3 2 1 0 | 1. | Students will develop an appreciation of how the history of art has influenced innovations in the |
|  |  | field of engineering, and explain the |
|  |  | impact of artistic expression as it |
|  |  | related to consumer products. |
| 3 2 1 0 | 2. | Students will research how artistic  period and style have influenced |
|  |  | product and architectural design. |
| 3 2 1 0 | 3. | Students will explore the design |
|  |  | concept of form and function, and  explain its use in product design. |
| 3 2 1 0 | 4. | Students will explore the evolution |
|  |  | of technology and be able to |
|  |  | identify engineering achievements  through history. |
| 3 2 1 0 | 5. | Students will research the |
|  |  | chronological development and |
|  |  | accelerating rate of change that  innovations in tools and materials |
|  |  | have brought about over time as it |
|  |  | relates to a given consumer product. |
| 3 2 1 0 | 6. | Students will review the history of  measurement tools and identify two |
|  |  | innovations that have led to |
|  |  | improved functionality of that tool. |
| 3 2 1 0 | 7. | Students will explore a given  professional organization, and |
|  |  | summarize in a short PowerPoint |
|  |  | presentation the range of services |
| 3 2 1 0 | 8. | provided by the organization.  Students will identify career |
|  |  | opportunities in design engineering |
|  |  | and explain their job functions. |
| 3 2 1 0 | 9. | Students will explore career  opportunities in a given engineering |
|  |  | field and list the educational |
|  |  | requirements for each profession. |

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| 3 2 1 0 | 10. | Students will list the seven steps of the design process and explain the | 3 2 1 0 | 21. | Students will demonstrate the ability to produce two-dimensional |  |  | rectangles, squares, rhombus, trapezoid, pentagon, hexagon, and |
|  |  | activities that occur during each |  |  | geometric figures. |  |  | octagon). |
|  |  | phase. | 3 2 1 0 | 22. | Students will select and produce the | 3 2 1 0 | 33. | Using a compass, ruler and triangle, |
| 3 2 1 0 | 11. | Students will assess the value of |  |  | appropriate pictorial style to best |  |  | students will construct various |
|  |  | working as a team and understand  the benefits of collaboration. |  |  | communicate solutions in the design  process. | 3 2 1 0 | 34. | geometric shapes.  Students will define terminology |
| 3 2 1 0 | 12. | Students will investigate the | 3 2 1 0 | 23. | Students will formulate pictorial |  |  | associated with arcs and circles. |
|  |  | principles and elements of design |  |  | sketches to develop ideas, solve | 3 2 1 0 | 35. | Using a compass, ruler and triangle, |
|  |  | and demonstrate their use in the  design process. |  |  | problems, and understand  relationships during the design |  |  | students will construct arcs, circles  and ellipses. |
| 3 2 1 0 | 13. | Students will identify career |  |  | process. | 3 2 1 0 | 36. | Students will distinguish and define |
|  |  | opportunities in design engineering | 3 2 1 0 | 24. | Students will create sketches |  |  | geometric constraints. |
| 3 2 1 0 | 14. | and explain their job functions.  Students will express their |  |  | utilizing both the additive and  subtractive methods to assess | 3 2 1 0 | 37. | Students will identify the following  geometric constraints in given three |
|  |  | understanding of the principles and |  |  | underlying geometric and |  |  | dimensional models: horizontal, |
|  |  | elements of design utilized in |  |  | perceptual principles. |  |  | vertical, parallel, perpendicular, |
|  |  | products, print media, and art  forms. | 3 2 1 0 | 25. | Students will select a sketching  method that is efficient in its use of |  |  | tangent, concentric, collinear,  coincident, and equal. |
| 3 2 1 0 | 15. | Students will collect and display |  |  | color, form, and symbols | 3 2 1 0 | 38. | Students will apply the right hand |
|  |  | examples of the application of the |  |  | representing abstract data. |  |  | rule to identify the X, Y, and Z axes |
|  |  | principles and elements o design  utilized in products, print media, | 3 2 1 0 | 26. | Students will augment pictorial  sketches with shading to improve | 3 2 1 0 | 39. | of the Cartesian Coordinate System.  Students will apply a combination of |
|  |  | and art forms. |  |  | communication. |  |  | absolute, relative, and polar |
| 3 2 1 0 | 16. | Students will identify the proper | 3 2 1 0 | 27. | Students will evaluate and select the |  |  | coordinates to construct a three- |
|  |  | elements of a fully developed  portfolio. |  |  | necessary views to graphically  communicate design solutions. | 3 2 1 0 | 40. | dimensional model.  Students will define the origin |
| 3 2 1 0 | 17. | Students will identify and discuss | 3 2 1 0 | 28. | Students will interpret annotated |  |  | planes in the Coordinate System. |
|  |  | the ethical issues surrounding |  |  | sketches in the design analysis | 3 2 1 0 | 41. | Students will experience the |
| 3 2 1 0 | 18. | portfolio artifacts.  Students will compare and contrast | 3 2 1 0 | 29. | process.  Students will integrate annotated | 3 2 1 0 | 42. | creative thinking process  Students will recognize the |
|  |  | defined elements of a good portfolio |  |  | sketches in presentations, portfolio, |  |  | difference between vertical and |
|  |  | specified in the PowerPoint |  |  | and documentation processes. |  |  | lateral thinking. |
|  |  | presentation to the sample provided  in the PLTW Design Resource Guide. | 3 2 1 0 | 30. | Students will develop properly  annotated sketches to accurately | 3 2 1 0 | 43. | Students will categorize and select a  solution to a problem. |
| 3 2 1 0 | 19. | Students will develop a portfolio to |  |  | convey data in design solution. | 3 2 1 0 | 44. | Students will communicate their |
|  |  | organize and display evidence of | 3 2 1 0 | 31. | Students will define and contrast |  |  | idea through written and verbal |
| 3 2 1 0 | 20. | their work.  Students will integrate proper | 3 2 1 0 | 32. | points, lines and line segments.  Students will identify major | 3 2 1 0 | 45. | formats.  Students will identify the different |
|  |  | sketching techniques and styles in |  |  | geometric shapes (isosceles triangle, |  |  | geographical methods of data |
|  |  | the creation of sketches. |  |  | right triangle, scalene triangle, |  |  | representation. |

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| 3 2 1 0 | 46. | Students will select the appropriate graphical format to a problem. | 3 2 1 0 | 60. | Students will demonstrate the ability to modify a sketched feature | 3 2 1 0 | 73. | Students will explore and demonstrate assembly modeling |
| 3 2 1 0 | 47. | Students will analyze and develop |  |  | of a model. |  |  | skills to solve a variety of design |
|  |  | graphical representation of given | 3 2 1 0 | 61. | Students will explore and |  |  | problems. |
|  |  | data. |  |  | demonstrate assembly modeling | 3 2 1 0 | 74. | Students will understand and apply |
| 3 2 1 0 | 48. | Students will have an understanding  of the different physical modeling |  |  | skills to solve a variety of design  problems. |  |  | drive constraints to simulate the  motion of parts in assemblies. |
|  |  | techniques. | 3 2 1 0 | 62. | Students will understand and apply | 3 2 1 0 | 75. | Students will explore and |
| 3 2 1 0 | 49. | Students will present a model with |  |  | the base component effectively in |  |  | demonstrate assembly modeling |
| 3 2 1 0 | 50. | its correct proportions.  Students will select the appropriate |  |  | the assembly modeling  environment. |  |  | skills to solve a variety of design  problems. |
|  |  | modeling materials to complete a | 3 2 1 0 | 63. | Students will place and create 3 2 1 0 76. Students will explore, understand, | | | |
|  |  | three-dimensional model. |  |  | components effectively in the and apply adaptive design concepts  during development | | | |
| 3 2 1 0 | 51. | Students will evaluate a problem  using mathematical formulas | 3 2 1 0 | 64. | assembly modeling environment. of sketches, features, parts and  Students will create circular and assemblies. | | | |
| 3 2 1 0 | 52. | Students will analyze a solution to a |  |  | rectangular patterns of components 3 2 1 0 77. Students will explore and | | | |
|  |  | problem using the correct format of |  |  | within an assembly model. demonstrate assembly modeling | | | |
| 3 2 1 0 | 53. | analysis.  Students will interpret a sketch | 3 2 1 0 | 65. | Students will replace components skills to solve a variety of design  with modified external parts. problems. | | | |
|  |  | using a CAD package. | 3 2 1 0 | 66. | Students will perform part 3 2 1 0 78. Students will demonstrate how to | | | |
| 3 2 1 0 | 54. | Students will explain the difference |  |  | manipulation during the creation of extract mass properties data from | | | |
|  |  | between parametric and adaptive  designs and be able to specify their | 3 2 1 0 | 67. | an assembly model. their solid models.  Students will explore and 3 2 1 0 79. Students will evaluate the accuracy | | | |
|  |  | uses. |  |  | demonstrate assembly modeling of mass properties calculations. | | | |
| 3 2 1 0 | 55. | Students will draw a two- |  |  | skills to solve a variety of design 3 2 1 0 80. Students will describe how analysis | | | |
|  |  | dimensional sketch using CAD  package. | 3 2 1 0 | 68. | problems. data can be used to update  Students will perform part parametric models. | | | |
| 3 2 1 0 | 56. | Students will apply geometrical and |  |  | manipulation during the creation of 3 2 1 0 81. Students will generate an isometric | | | |
|  |  | dimensional constraints to a sketch. |  |  | an assembly model. view from orthographic drawing | | | |
| 3 2 1 0 | 57. | Students will demonstrate the  ability to generate a three- | 3 2 1 0 | 69. | Students will apply assembly views.  constraints to successfully construct 3 2 1 0 82. Students will determine the correct | | | |
|  |  | dimensional model. |  |  | a multi-part object. application for the various section | | | |
| 3 2 1 0 | 58. | Students will understand and | 3 2 1 0 | 70. | Students will utilize part libraries views. | | | |
|  |  | demonstrate the use of work  features and how they are applied |  |  | effectively during the assembly 3 2 1 0 83. Students will describe the purpose modeling process. and application of hatch marks and | | | |
|  |  | while constructing a solid model. | 3 2 1 0 | 71. | Students will explore and a cutting plane line, as used in a | | | |
| 3 2 1 0 | 59. | Students will recognize the use and |  |  | demonstrate assembly modeling section view. | | | |
|  |  | need of work planes, axes, and  points in the development of a |  |  | skills to solve a variety of design 3 2 1 0 84. Students will create the appropriate problems. section view for a specified view. | | | |
|  |  | computer model. | 3 2 1 0 | 72. | Students will employ sub-assemblies | | | |
|  |  |  |  |  | during the production of assemblies. | | | |

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| 3 2 1 0 | 85. | Students will create a detail view that corresponds to the appropriate |  |  | communicate information relating to product design. | 3 2 1 0 | 113. | Students will evaluate and apply the correct machine process. |
|  |  | orthographic drawing view. | 3 2 1 0 | 104. | Students will demonstrate the | 3 2 1 0 | 114. | Students will recognize the need to |
| 3 2 1 0 | 86. | Students will create an auxiliary |  |  | following communications |  |  | limit the number of processes used |
|  |  | view to show the detail on an |  |  | techniques: voice variation, eye |  |  | to manufacture a product. |
| 3 2 1 0 | 87. | inclined surface of a drawing object.  Students will list the common |  |  | contact, posture, attire, practice and  preparation, and projecting | 3 2 1 0 | 115. | Students will develop an  understanding of process routing. |
|  |  | dimensioning standards. |  |  | confidence. | 3 2 1 0 | 116. | Students will distinguish the |
| 3 2 1 0 | 88. | Students will identify and | 3 2 1 0 | 105. | Students will have an understanding |  |  | differences between CNC, FMS, and |
|  |  | demonstrate the use of common  dimensioning systems. |  |  | of various forms of visual aids and  when to use them in a presentation. | 3 2 1 0 | 117. | CIM.  Students will explain the need for a |
| 3 2 1 0 | 89. | Students will describe the | 3 2 1 0 | 106. | Considering the audience and level |  |  | company to minimize material |
|  |  | characteristics and demonstrate the |  |  | of formality, students will select the |  |  | handling by procurement of |
|  |  | use of unidirectional and aligned  dimensioning. |  |  | most appropriate type of visual aid  for a presentation. |  |  | materials in a timely fashion.  Students should explain the JIT |
| 3 2 1 0 | 90. | Students will differentiate the use of | 3 2 1 0 | 107. | Students will identify the need to |  |  | process. |
|  |  | and demonstrate an understanding |  |  | evaluate the areas of manpower | 3 2 1 0 | 118. | Students will identify the need to |
|  |  | of size and location dimensions by  applying these types of dimensions | 3 2 1 0 | 108. | and facility requirements.  Considering the audience and level | 3 2 1 0 | 119. | perform a cost analysis of a product.  Students will interpret data, which |
|  |  | to annotated sketches and drawings |  |  | of formality, students will select the |  |  | has been statistically analyzed, to |
| 3 2 1 0 | 91. | Students will demonstrate |  |  | most appropriate type of written |  |  | ensure product quality. |
|  |  | appropriate dimensioning rules and  practices. | 3 2 1 0 | 109. | documentation for a presentation.  Students will identify the elements | 3 2 1 0 | 120. | Students will recognize the need to  protect a product for shipping. |
| 3 2 1 0 | 92. | Students will set up and integrate |  |  | of the various forms of written | 3 2 1 0 | 121. | Students will analyze aesthetic |
|  |  | the use of a customized common |  |  | documentation. |  |  | requirements to enhance packaging |
| 3 2 1 0 | 100. | dimensioning standard.  Students will identify and | 3 2 1 0 | 110. | Students will recognize the need to  involve all of the manufacturing | 3 2 1 0 | 122. | for the consumer.  Students will define, explain, and |
|  |  | demonstrate the use of |  |  | team members in the decision |  |  | demonstrate an understanding of |
|  |  | dimensioning practices on section, |  |  | making process of designing a |  |  | common vocabulary words used in |
| 3 2 1 0 | 101. | auxiliary, and assembly models.  Students will define and | 3 2 1 0 | 111. | product.  Students will be able to categorize |  |  | association with product cost  analysis. |
|  |  | demonstrate an understanding of |  |  | manufacturing specifications and | 3 2 1 0 | 123. | Students will formulate a product |
|  |  | tolerancing, and solve tolerance |  |  | constraints needed to produce a |  |  | cost analysis for a given product. |
| 3 2 1 0 | 102. | problems.  Students will apply appropriate | 3 2 1 0 | 112. | product.  Students will be able to evaluate | 3 2 1 0 | 124. | Students will demonstrate an  understanding of packaging design |
|  |  | annotations on sketches and |  |  | material characteristics for |  |  | requirements. |
|  |  | drawings. |  |  | manufacturing a specific product | 3 2 1 0 | 125. | Students will design a package for |
| 3 2 1 0 | 103. | Students will understand and  formulate general and proprietary |  |  | and identify the correct  manufacturing process needed to | 3 2 1 0 | 126. | given product.  Listen for and identify key words. |
|  |  | specifications to further |  |  | produce that product. | 3 2 1 0 | 127. | Listen for words that identify a |
|  |  |  |  |  |  |  |  | procedure. |

**21009 Robotics**

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| 3 2 1 0 | 128. | Listen for steps or actions to be performed. |  |  | subtractive methods to assess underlying geometric and |
| 3 2 1 0 | 129. | Listen for clues regarding the order |  |  | perceptual principles |
|  |  | or sequence in which a task is | 3 2 1 0 | 141. | Students will interpret annotated |
|  |  | performed. |  |  | sketches in the design analysis |
| 3 2 1 0 | 130. | Draw conclusions or make  generalizations from another's oral | 3 2 1 0 | 142. | process  Using a compass, ruler and triangle, |
|  |  | communication. |  |  | students will construct arcs, circles |
| 3 2 1 0 | 131. | Locate information and select the |  |  | and ellipses |
|  |  | materials, tools, equipment, or  other resources to perform the | 3 2 1 0 | 143. | Students will apply the right hand  rule to identify the X, Y, and Z axes |
|  |  | activities needed to accomplish a |  |  | of the Cartesian Coordinate System. |
|  |  | specific task. | 3 2 1 0 | 144. | Students will identify the Origin and |
| 3 2 1 0 | 132. | Develop strategies to overcome  procrastination and meet deadlines. |  |  | planar orientations of each side of a  three-dimensional model. |
| 3 2 1 0 | 133. | Value diversity, practice tolerance | 3 2 1 0 | 145. | Students will identify the different |
|  |  | and acceptance, and work |  |  | geographical methods of data |
|  |  | cooperatively toward common  goals. | 3 2 1 0 | 146. | representation.  Students will evaluate a problem |
| 3 2 1 0 | 134. | Communicate creatively with |  |  | using mathematical formulas |
|  |  | stories, examples, pictures, props, | 3 2 1 0 | 147. | Students will draw a two- |
| 3 2 1 0 | 135. | etc., to help convey your message.  Apply one or more problem-solving |  |  | dimensional sketch using CAD  package |
|  |  | processes to a given situation(s). | 3 2 1 0 | 148. | Students will create circular and |
| 3 2 1 0 | 136. | Establish and examine personal |  |  | rectangular patterns of components |
|  |  | short- and long-term goals, including  resources needed to reach these | 3 2 1 0 | 149. | within an assembly model.  Students will explore and |
|  |  | goals. |  |  | demonstrate assembly modeling |
| 3 2 1 0 | 137. | Students will review the history of |  |  | skills to solve a variety of design |
|  |  | measurement tools and identify two  innovations that have led to | 3 2 1 0 | 150. | problems.  Students will describe how analysis |
|  |  | improved functionality of that tool |  |  | data can be used to update |
| 3 2 1 0 | 138. | Students will investigate the |  |  | parametric models. |
|  |  | principles and elements of design  and demonstrate their use in the | 3 2 1 0 | 151. | Students will generate an isometric  view from orthographic drawing |
|  |  | design process 3 2 1 0 |  |  | views. |
| 3 2 1 0 | 139. | Students will demonstrate the | 3 2 1 0 | 152. | Students will create a detail view |
|  |  | ability to produce two-dimensional  geometric figures. |  |  | that corresponds to the appropriate  orthographic drawing view. |
| 3 2 1 0 | 140. | Students will create sketches |  |  |  |
|  |  | utilizing both the additive and |  |  |  |

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| 3 2 1 0  3 2 1 0 | 1.  2. | Build or assemble robotic devices or systems.  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 |
| 3 2 1 0 | 4. | pneumatics.  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. |

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

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|  | | | **39108 Advanced Production** 3 2 1 0 | | | 1. | Understand the theoretical, practical, and contextual issues that |
| **Blueprint Reading** | | |  | influence design: |
| 3 2 1 0 | 11. | Verify dimensions and clearances |  | | |  | a. Understand the ways in which |
|  |  | of parts to ensure conformance to | 4 3 2 1 0 1. Identify and interpret symbols | | |  | sociocultural conditions and issues |
|  |  | specifications, using precision | specific to manufacturing production | | |  | influence architectural design. |
|  |  | measuring instruments. | and a variety of technical fields, such | | |  | b. Use the necessary equipment |
| 3 2 1 0 | 12. | Debug robotics programs. as mechanical, electrical, plumbing for producing an architectural  and pipefitting, power distribution, | | | | | |
| 3 2 1 0 | 13. | Read and utilize blueprints in the process and instrumentation, design and the appropriate | | | | | |
|  |  | technical process. architectural, and process flow methods and techniques for | | | | | |
| 3 2 1 0 | 14. | Read and utilize production layouts. diagrams. employing the equipment. | | | | | |
| 3 2 1 0 | 15. | Read and utilize technical drawings 4 3 2 1 0 2. Interpret work from multiview c. Use freehand graphic | | | | | |
|  |  | as necessary in robotic assembly |  | drawings and computer models used |  |  | communication skills to represent |
|  |  | and usage. |  | in manufacturing applications to |  |  | conceptual ideas, analysis, and |
| 3 2 1 0 | 16. | Troubleshoot mechanical failures or |  | include engineering, architectural, |  |  | design concepts. |
|  |  | unexpected problems. |  | and schematic representations. | 3 2 1 0 | 2. | Students understand the use of |
| 3 2 1 0 | 17. | Integrate robotics with peripherals | 4 3 2 1 0 | 3. Determine processes and procedures |  |  | computer-aided drafting and design |
|  |  | or other equipment. |  | for diagnostic applications or job |  |  | (CADD) in developing architectural |
| 3 2 1 0 | 18. | Demonstrate knowledge of how  automated robotic systems | 4 3 2 1 0 | completion.  4. Demonstrate proficiency reading | 3 2 1 0 | 3. | design  Use CADD software to develop a |
|  |  | increase production volume and |  | technical information including |  |  | preliminary architectural design. |
| precision in a variety of high- dimensioning techniques. 3 2 1 0 4. Students will create written and | | | | | | | |
|  |  | throughput operations. | 4 3 2 1 0 | 5. Visualize shapes and objects in | digital portfolios. | | |
| 3 2 1 0 | 19. | Resolve engineering or science  problems using robots. |  | multiple views to interpret various  drawings used in manufacturing, | **Computer Hardware, Electrical, and Networking** | | |
| 3 2 1 0 | 20. | Analyze test results in relation to |  | commercial, and industrial | **Engineering** | | |
|  |  | design or rated specifications and  test objectives, and modify or |  | manufacturing which may include  electrical, schematics, plumbing, | 3 2 1 0 5. Understand the  characteristics of alternating | | |
|  |  | adjust equipment to meet  specifications. |  | piping ISO’s, piping and instrumentation diagrams, | current (AC) and how AC is generated; the characteristics | | |
| 3 2 1 0 | 21. | Record test procedures and |  | architectural and civil. | of the sine wave; the basic | | |
|  |  | results, numerical and graphical | 4 3 2 1 0 | 6. Develop a work order from | characteristics of AC circuits, | | |
|  |  | data, and recommendations for |  | production blueprint to create a | tuned circuits, and resonant | | |
|  |  | changes in product |  | product from a multiview drawing**.** | circuits; and the nature of the | | |
|  |  |  |  |  | frequency spectrum. | | |
| **21005 Engineering Comprehensive** 3 2 1 0 | | | | | | 6. | Calculate, construct, measure, and |
|  | | | | | |  | interpret both AC and DC circuits. |
| **Architectural and Structural Engineering** 3 2 1 0 | | | | | | 7. | Use appropriate electronic |
|  | | | | | |  | instruments to analyze, repair, or |

## Engineering Design

3 2 1 0 17. Know historical and current events that have relevance to engineering design.

3 2 10 18. Understand the development of graphic language in relation to engineering design.

3 2 1 0 19. Use the appropriate methods and techniques for employing all

3 2 1 0 28. Analyze soil erosion and identify the causes.

3 2 1 0 29. Know the fundamental stages of geochemical cycles.

3 2 1 0 30. Understand the effects of weather fronts on regional air pollution.

3 2 1 0 31. Know the major systems used to monitor, analyze, and predict conditions of meteorological

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| 3 2 1 0 20. | engineering design equipment. events.  Apply conventional engineering | | | |
|  | design processes and procedures | | | |
|  | accurately, appropriately, and **21201-Foundations of Electronics** | | | |
|  | safely. | | | |
| 3 2 1 0 21. | Apply the concepts of engineering **Lab Practices** | | | |
|  | design to the tools, equipment, | 3 2 1 0 | 1. | Apply proper OSHA safety |
|  | projects, and procedures of the |  |  | standards. |
|  | Engineering Design Pathway. | 3 2 1 0 | 2. | Make electrical connections. |
| 3 2 1 0 22. | Understand scalars and vectors | 3 2 1 0 | 3. | Identify and use hand tools properly |
|  | and solve problems by using the  concept of vectoring to predict the resultant forces. | 3 2 1 0  3 2 1 0 | 4.  5. | Demonstrate acceptable soldering and desoldering techniques.  Demonstrate knowledge of surface |
| 3 2 1 0 23. | Know the six simple machines and  their applications. |  |  | mount technology. |
| 3 2 1 0 24. | Know the common structure and | | | |
|  | **Demonstrate Proficiency in DC Circuits**  processes of a quality assurance | | | |
|  | 3 2 1 0 6. Solve algebraic problems to include  cycle. | | | |
| 3 2 1 0 25. | exponentials (prerequisite to DC).  Calibrate and measure objects by | | | |
|  | 3 2 1 0 7. Relate electricity to the nature of  using precision measurement tools | | | |
|  | matter.  and instruments. 3 2 1 0 8. Identify sources of electricity. | | | |

## Environmental and Natural Science Engineering

|  |  |  |
| --- | --- | --- |
|  | | measure electrical and electronic systems, circuits, or components. |
| 3 2 1 0 | 8. | Analyze and predict the effects |
|  |  | of circuit conditions on the |
|  |  | basis of measurements and |
|  |  | calculations of voltage, current,  resistance, and power. |
| 3 2 1 0 | 9. | Know the function and interaction  of basic computer components and |
| 3 2 1 0 | 10. | peripherals.  Understand the relationship among |
|  |  | computer hardware, networks, and  operating systems. |
| 3 2 1 0  3 2 1 0 | 11.  12. | Understand the steps in the design  process.  Understand the terminology used |
|  |  | in the design, assembly, |
|  |  | configuration, and implementation  of data systems networks. |
| 3 2 1 0 | 13. | Know the fundamental elements |
|  |  | of the major networking models |
|  |  | established by the industry  standards of recognized |
|  |  | organizations (e.g., the Open |
|  |  | System Interconnect [OSI] or |
|  |  | transmission-control/Internet  protocol [TCP/IP] models). |
| 3 2 1 0 | 14. | Understand the composition and |
|  |  | function of the various networks, |
|  |  | including local area networks  (LANs), medium area networks |
|  |  | (MANs), and wide area networks |
|  |  | (WANs). |
| 3 2 1 0 | 15. | Know the common potential  threats to networks and ways to |
|  |  | neutralize them. |
| 3 2 1 0 | 16. | Know the main functions of and |
|  |  | installation protocols for firewalls, |
|  |  | virus detection software, and  other security measures. |

3 2 1 0 26. Classify the three major groups of rocks according to their origin on the basis of texture and mineral composition.

3 2 1 0 27. Analyze the importance and use of soil, and evaluate how soil may be preserved and conserved.

3 2 1 0 9. Define voltage, current, resistance, power, and energy.

3 2 1 0 10. Apply and relate Ohm’s law.

3 2 1 0 11. Read and interpret color codes and symbols to identify electrical components and values.

3 2 1 0 12. Measure properties of a circuit

using VOM and DVM meters.

3 2 1 0 13. Computer and measure

conductance and resistance of conductors and insulators.

3 2 1 0 14. Apply Ohm’s law to series circuits.

3 2 1 0 15. Construct and verify operation of series circuits.

3 2 1 0 16. Troubleshoot series circuits.

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 | 17. | Apply Ohm’s law to parallel  circuits. |
| 3 2 1 0 | 18. | Construct and verify operation of |
|  |  | series-parallel circuits. |
| 3 2 1 0 | 19. | Troubleshoot series-parallel |
| 3 2 1 0 | 20. | circuits.  Construct and verify the operation |
|  |  | of series-parallel circuits. |
| 3 2 1 0 | 21. | Troubleshoot series-parallel |
|  |  | circuits. |
|  |  | circuits (loaded and unloaded). |
| 3 2 1 0 | 23. | Construct and verify the operation |
|  |  | of voltage divider circuits (loaded  and unloaded). |
| 3 2 1 0 | 24. | Troubleshoot voltage divider |
|  |  | circuits (loaded and unloaded). |
| 3 2 1 0 | 25. | Apply maximum power theory. |
| 3 2 1 0 | 26. | Construct and verify the operation |
|  |  | of DC circuits that demonstrate |
|  |  | the maximum power transfer |
| 3 2 1 0 | 27. | theory.  Define magnetic properties of |
|  |  | circuits and devices. |
| 3 2 1 0 | 28. | Determine the physical and |
|  |  | electrical characteristics of  capacitors and inductors. |
| 3 2 1 0 | 29. | Define RC and RL time constants. |
| 3 2 1 0 | 30. | Identify the output of |
| 3 2 1 0 | 31. | differentiators and integrators.  Troubleshoot differentiator and |
|  |  | Integrator circuits. |
| 3 2 1 0 | 32. | Set up and operate a DVM for DC |
|  |  | circuits. |

3 2 1 0 33. Set up and operate power supplies for DC circuits.

3 2 1 0 34. Set up and operate oscilloscopes

for DC circuits.

3 2 1 0 35. Define basic motor theory and

operation.

## Demonstrate Proficiency in AC Circuits

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 | 37. | Identify properties of an AC signal |
| 3 2 1 0 | 38. | Identify AC sources |
| 3 2 1 0 | 39. | Analyze and measure AC signals |
|  |  | using oscilloscope, frequency |
| 3 2 1 0 | 40. | meter, and generator.  Define the characteristics of AC |
|  |  | capacitive circuits. |
| 3 2 1 0 | 41. | Construct and verify the operation |
|  |  | of AC capacitive circuits. |
|  |  | circuits. |
| 3 2 1 0 | 43. | Define the characteristics of AC |
| 3 2 1 0 | 44. | inductive circuits.  Troubleshoot AC inductive circuits. |
| 3 2 1 0 | 45. | Define and apply the principals of |
|  |  | transformers to AC circuits. |
| 3 2 1 0 | 46. | Construct and verify the operation  of AC circuits utilizing |
|  |  | transformers. |
| 3 2 1 0 | 47. | Troubleshoot AC circuits utilizing |
| 3 2 1 0 | 48. | transformers.  Define the characteristics of RLC |
|  |  | circuits (series, parallel, and |
|  |  | complex). |
| 3 2 1 0 | 49. | Define the characteristics of series  and parallel resonant circuits. |
| 3 2 1 0 | 50. | Construct and verify the operation |
|  |  | of series and parallel resonant |
| 3 2 1 0 | 51. | circuits.  Define the characteristics of filter |
|  |  | circuits. |

3 2 1 0 52. Construct and verify the operation of filter circuits.

3 2 1 0 53. Troubleshoot filter circuits.

3 2 1 0 54. Define the characteristics of

polyphase circuits.

3 2 1 0 55. Setup and operate a DVM for AC

circuits.

3 2 1 0 56. Setup and operate power supplies for AC circuits.

3 2 1 0 57. Setup and operate oscilloscopes

for AC circuits.

3 2 1 0 58. Setup and operate frequency

counters for AC circuits.

3 2 1 0 59. Analyze capacitor/inductor for AC circuits.

3 2 1 0 60. Setup and operate impedance

bridges for AC circuits.

# 21054 Technical Innovation and Assessment

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

3 2 1 0 1. Explain the design process:

1. Define a problem

b. Brainstorm

1. Research and generate Ideas
2. Recognition of identifying criteria and constraints and possible solutions
3. Design Proposal
4. Modeling and Prototyping
5. Testing and Evaluating

h. Refining

1. Production
2. Communication of Results

3 2 1 0 2. Identify solutions and problems that go beyond the expected and

obvious.

3 2 1 0 3. Identify sciences and technology

areas most impacted and with most potential to utilize the new technologies.

3 2 1 0 4. Be able to explain why it is

important for STEM professionals to practice innovation.

3 2 1 0 5. Be able to discuss the advantages,

disadvantages, and prospects of current emerging technologies.

3 2 1 0 6. Discuss in depth a chosen innovative technology, based on independent research.

3 2 1 0 7. Explain the change process.

3 2 1 0 8. Develop a plan for anticipating

change.

3 2 1 0 9. Address each of the following areas to varying degrees based on available information:

1. anticipated employment,
2. drivers and constraints,
3. size and location of market,
4. connection(s) to existing technologies,
5. ability and ease of replication,
6. physical and capital costs,
7. industry and education partnerships to be leveraged,
8. national best practices,
9. illustrate qualifications, and recommendations, aims and approaches for the Technological innovation
10. Innovation system modeling
11. Technology monitoring, forecasting and assessment
12. Trend analysis methods & scenarios

## APPLICATI

**21053 E**

Coursework sh the locally ado example/foun

|  |  |  |
| --- | --- | --- |
| 3 2 1 0  3 2 1 0 | 1.  2. | 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. |

recommendations, aims and approaches for the Technological innovation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| m.  n. | Impact assessment Risk analysis | 3 2 1 0 | 9. | Develop a plan for anticipating change. |
| o. | Action (policy) analysis | 3 2 1 0 | 10. | Address each of the following areas |
| p. | Technology road mapping |  |  | to varying degrees based on |
| q. | Communication and |  |  | available information: |
|  | implementation of innovation  forecasts |  |  | a. anticipated employment,  b.drivers and constraints, |
| **ON LEVEL COURSES**  **merging Technologies**  ould represent objectives reflective of pted process. Those listed below are dational only.  Demonstrate the research skills | | | | c. size and location of market, |
| d.connection(s) to existing |
| technologies, |
| e.ability and ease of replication, |
| f. physical and capital costs, |
| g. industry and education |
| partnerships to be leveraged, |
| h.national best practices, |
| i. illustrate qualifications, and |

1. Innovation system modeling
2. Technology monitoring, forecasting and assessment
3. Trend analysis methods & scenarios
4. Impact assessment
5. Risk analysis
6. Action (policy) analysis p.Technology road mapping q.Communication and

implementation of innovation forecasts

# 21008 Digital Electronics

3 2 1 0 1. Students will be able to identify

hazards in the lab and know locations of the MSDS, safety

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | equipment, and how to utilize these resources. | 3 2 1 0 | 12. | Students will correctly select and utilize electrical meters to | 3 2 1 0 23. | Students will recognize the relationship between the Boolean |
| 3 2 1 0 | 2. | Students will understand the causes |  |  | determine voltage, resistance, and |  | expression, logic diagram, and truth |
|  |  | of and the dangers from electric |  |  | current in simple circuits. |  | table. |
|  |  | shock and explain methods to | 3 2 1 0 | 13. | Students will calculate the | 3 2 1 0 24. | Students will be able to create |
| 3 2 1 0 | 3. | prevent it.  Students will understand that the |  |  | resistance, current and voltage in a  circuit using Ohm's law. |  | Boolean Expressions, logic circuit  diagrams or truth tables from |
|  |  | process of designing an electronic | 3 2 1 0 | 14. | Students will describe the |  | information provided in the solution |
|  |  | circuit takes into account many |  |  | component parts of a capacitor and |  | of design problems. |
|  |  | factors, including environmental  concerns, and will be familiar with |  |  | describe how a capacitor holds a  static charge. | 3 2 1 0 25. | Students will apply the rules of  Boolean algebra to logic diagrams |
|  |  | precautionary measures. | 3 2 1 0 | 15. | Students will use and understand |  | and truth tables to minimize the |
| 3 2 1 0 | 4. | Students will be able to define and |  |  | the units of measurement for |  | circuit size necessary to solve a |
|  |  | explain the difference between  direct and alternating currents. |  |  | various electronic parts and be able  to calculate their characteristics | 3 2 1 0 26. | design problem.  Students will use DE Morgan’s |
| 3 2 1 0 | 5. | Students will be able to convert |  |  | mathematically and through |  | Theorem to simplify a negated |
|  |  | number values from binary, |  |  | instrumentation. |  | expression and to convert an SOP to |
| 3 2 1 0 | 6. | hexadecimal, and decimal formats.  Students will understand the | 3 2 1 0 | 16. | Students will be familiar with  different types of capacitors and |  | a POS and vice versa, in order to  save resources in the production of |
|  |  | material makeup of resistors and |  |  | their voltage polarity requirements. |  | circuits. |
|  |  | how they are used in circuit design. | 3 2 1 0 | 17. | Students will be able to draw a | 3 2 1 0 27. | Students will formulate and employ |
| 3 2 1 0 | 7. | Students will understand the  blueprint/schematic symbols |  |  | digital waveform and identify the  anatomy of the waveform. |  | a Karnaugh Map to reduce Boolean  expressions and logic circuits to |
|  |  | corresponding to various parts used | 3 2 1 0 | 18. | Students will differentiate between |  | their simplest forms. |
|  |  | in electronics and circuitry. |  |  | digital and analog signals when | 3 2 1 0 28. | The students will create circuits to |
| 3 2 1 0 | 8. | Students will be able to correctly  setup lab equipment to safely | 3 2 1 0 | 19. | given the waveforms.  Students will wire and test a free- |  | solve a problem using NAND or NOR  gates to replicate all logic functions. |
|  |  | design, test, and utilize electronics |  |  | running clock circuit using a 555 | 3 2 1 0 29. | The students will apply their |
|  |  | designs. |  |  | timer. |  | understanding of the workings of |
| 3 2 1 0 | 9. | Students will calculate the tolerance  levels of various electronics parts to | 3 2 1 0 | 20. | Students will calculate the output  frequency of a clock circuit using |  | NOR and NAND gates to make  comparisons with standard |
|  |  | determine if the measured value is |  |  | observations and the oscilloscope. |  | combinational logic solutions to |
|  |  | within specifications for quality | 3 2 1 0 | 21. | Students will use schematics and |  | determine amount of resource |
| 3 2 1 0 | 10. | assurance/reliability.  Students will be able to draw and |  |  | symbolic Algebra to represent digital  gates in the creation of solutions to | 3 2 1 0 30. | reduction.  Students will restate and simplify a |
|  |  | label the parts of a simple circuit. |  |  | design problems. |  | digital design problem as part of the |
| 3 2 1 0 | 11. | Students will build and test a variety | 3 2 1 0 | 22. | Students will identify the name, |  | systematic approach to solving a |
|  |  | of series and parallel circuits, using  simulation software and proto- |  |  | symbol, and function and create the  truth table, and Boolean Expression | 3 2 1 0 31. | problem.  Students will discover the code to |
|  |  | boards, to prove the accuracy of |  |  | for the basic logic gates through |  | create numbers on a seven segment |
|  |  | Ohm's and Kirchhoff's laws. |  |  | research and experimentation. |  | display by experimentation. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 | 32. | Students will design a circuit to control a seven segment display |  |  | asynchronous flip-flops circuits they construct. |  | using discrete gates to solve a problem. |
|  |  | with a decimal to BCD encoder and | 3 2 1 0 | 44. | Students will be able to create and | 3 2 1 0 55. | Students will be able to formulate a |
|  |  | a display driver. |  |  | interpret timing diagrams and truth |  | flow chart to correctly apply basic |
| 3 2 1 0 | 33. | Students will control the flow of |  |  | tables for J-K Flip- Flops. |  | programming concepts in the |
|  |  | data by utilizing multiplexers and | 3 2 1 0 | 45. | Students will understand different |  | planning of a project. |
|  |  | demultiplexers. |  |  | types of triggers used by latches and | 3 2 1 0 56. | Students will appropriately select, |
| 3 2 1 0 | 34. | Students will be able to design and |  |  | flip-flops, and select the appropriate |  | size, and implement interface |
|  |  | implement combinational logic |  |  | one for the circuits they design. |  | devices to control external devices. |
|  |  | circuits using reprogrammable logic | 3 2 1 0 | 46. | Students will analyze timing | 3 2 1 0 57. | Students will design and create |
|  |  | devices. |  |  | diagrams that reflect triggering to |  | programming to control the position |
| 3 2 1 0 | 35. | Students will create PLD logic files |  |  | identify distinguishing |  | of stepper motors. |
|  |  | that define combinational circuit |  |  | characteristics. |  |  |
|  |  | designs using Boolean Expressions. | 3 2 1 0 | 47. | Students will conduct experiments | | |
| 3 2 1 0 | 36. | Students will understand and use |  |  | with clock pulse width to determine **21048 Workplace Experience** | | |
|  |  | logic compiler software to create |  |  | the effect on the accuracy of data | | |
|  |  | JEDEC files for programming PLDs. |  |  | transmission. | 3 2 1 0 1. Employ effective listening skills | |
| 3 2 1 0 | 37. | Students will demonstrate  understanding of binary addition | 3 2 1 0 | 48. | Students will assemble circuits and  compile information about the | when working with client.  3 2 1 0 2. Employ customer service | |
|  |  | and subtraction by designing circuits |  |  | various applications of flip- flops. | principles when working | |
| 3 2 1 0 | 38. | to produce correct answers.  Students will create and prove the | 3 2 1 0 | 49. | Students will conduct experiments  to determine the basic principles of | with consumers.  3 2 1 0 3. Evaluate and follow-up on customer | |
|  |  | truth table for both half and full  adders. | 3 2 1 0 | 50. | how shift registers work.  Students will evaluate the use of | service provided.  3 2 1 0 4. Employ safety skills and equipment | |
| 3 2 1 0 | 39. | Students will design, construct and  test adder circuits using both |  |  | shift registers in product design and  the speeds at which those products | usage in appropriate ways.  3 2 1 0 5. Be aware of MSDS (Material | |
|  |  | discrete gates and MSI gates. |  |  | run. | Safety Data Sheets) and other | |
| 3 2 1 0 | 40. | Students will conduct and test | 3 2 1 0 | 51. | Students will create a circuit using | safety resources and employ | |
|  |  | simple latches and flip-flops from |  |  | discrete flip-flops to discover the | those resources as required for | |
|  |  | discrete gates. |  |  | operation and characteristics of | the workplace. | |
| 3 2 1 0 | 41. | Students will interpret, design, |  |  | asynchronous counters. |  | |
|  |  | draw, and evaluate circuits using the | 3 2 1 0 | 52. | Students will design, simulate, build |  | |

logic symbols for latches and flip- flops.

3 2 1 0 42. Students will be able to interpret

and test Mod counters using discrete gates in the solution to a design problem.

# 21252 Materials Science and

**Engineering**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | waveform diagrams form circuits | 3 2 1 0 | 53. | Students will design, simulate, build |  | |
| they construct and compare them |  |  | and test asynchronous Mod | 3 2 1 0 1. | Identify key participants and events |
| with combinational waveforms. |  |  | counters using an integrated |  | in the science and history of |
| 3 2 1 0 | 23. | Students will compare and contrast |  |  | counter chip (MSI). |  | materials science and engineering, |
|  |  | operation of synchronous with | 3 2 1 0 | 54. | Students will design, simulate, build and test synchronous Mod counters |  | including areas of metallurgy, |

* Electrical properties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | polymers, ceramics, and composite development. | * Acoustical properties 3 2 1 0 * Acoustical absorption * Speed of sound | 10. | Identify reasons for particular materials to be chosen over other |
| 3 2 1 0 | 2. | Identify professional organizations | * Environmental properties |  | materials for specific applications. |
|  |  | and resources available to provide | o Embodied energy (sustainability … 3 2 1 0 | 11. | Identify various methods for |
|  |  | additional information on materials | used in LEED)  o RoHS compliance (Hazardous |  | physical bonding of materials. |
|  |  | science. | Materials) 3 2 1 0 | 12. | Explain appropriate |
| 3 2 1 0 | 3. | Recognize and know how to utilize | * Atomic properties   o Atomic number - applies to pure |  | usage/advantage of physical bonds |
|  |  | the MSDS information in the | elements only |  | over chemical bonds in various |
|  |  | workplace and where to find it. | o Atomic mass - applies to |  | applications. |
| 3 2 1 0 | 4. | Recognize physical properties of individual isotopes or specific 3 2 1 0 13. Identify various methods for mixtures of isotopes of a given | | | |
|  |  | materials: solid, liquid, gas, and element (useful in discussion of chemical bonding of materials. | | | |
|  |  | plasma. alloys & composites). 3 2 1 0 14. Explain appropriate Manufacturing properties | | | |
| 3 2 1 0 | 5. | (#4 Primary Alternate) Recognize o Machining speeds and feeds usage/advantage of chemical | | | |
|  |  | materials properties(such as but not o Machinability rating bonds over physical bonds in  o Hardness | | | |
|  |  | limited to): o Extruding temperature and various applications.   * Mechanical properties pressure 3 2 1 0 15. Define tribology and its * Compressive strength o Castability importance. * Ductility 3 2 1 0 6. (#4 Secondary Alternate) Recognize * Hardness key properties of materials: 3 2 1 0 16. Describe the impact of * Specific Weight biomaterials on the industry. * Tensile Strength reactivity, toxicity, flammability, 3 2 1 0 17. Identify and describe a material * Density stability | | | |

* Electrical conductivity
* Dielectric/Piezoelectric properties
* Thermal properties o Thermal conductivity o Thermal expansion o Heat of vaporization
* Flammability/FlashPoint/Autoigni- tion Temperature
* Vapor Pressure o Melting Point o Boiling Point
* Curie point (loss of magnetism by heat)
* Chemical properties

o pH

* Reactivity
* Solubility (ionic vs. covalent)
* Corrosion resistance
* Magnetic properties
* Permeability
* Optical properties
* Absorptivity
* Reflectivity
* Refractive index
* Color
* Transmittance
* Scattering

that has recently become available or has recently been adopted for widespread use and how it may impact future design and development.

Describe manufacturing processes that have changed due to availability of new materials.

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| --- | --- |
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|  |  |
| 3 2 1 0 | 18. |
| 3 2 1 0 | 19. |

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| --- | --- | --- |
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|  |  |  |
|  |  |  |
|  |  |  |
| 3 2 1 0 | 7. | Recognize the various classes of  materials, such as crystals (ionic |
|  |  | and covalent), metals, |
|  |  | intermetallics (alloys), |
|  |  | semiconductors, polymers,  composite materials, and |
|  |  | ceramics/vitreous (glasslike) |
|  |  | materials. |
| 3 2 1 0 | 8. | Identify the fundamentals of  materials in terms of material |
|  |  | structural properties; |
|  |  | behaviors under varying |
|  |  | conditions, bonding,  electrical/magnetic |
|  |  | conductivity, chemical |
|  |  | reaction, and decomposition |
|  |  | behaviors (ie.  oxidation/rust/crazing). |
| 3 2 1 0 | 9. | Give examples of specialized usage |
|  |  | of materials in industry. |

Identify and describe a testing technique for the integrity of a part made from a particular material (examples might be stress/pressure testing, magnaflux, diffraction techniques, x-ray, sonic, etc).

# 21015 Particular Topics in Engineering

## Coursework should represent explicit objectives measured against target skills

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

/Employment (beyond the Emerging Technology Course)

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

|  |  |  |
| --- | --- | --- |
| 3 2 1 0 | 1. | Define scope of work (or area to be researched) and appropriately |
|  |  | document the process. |
| 3 2 1 0 | 2. | Summarize the process of |
|  | | engineering a new design or  utilization of material to be |
| examined. |
| a. Plan for products/services using |

reliability factors.

1. Demonstrate knowledge of the key functions and subsystems of the product.
2. Demonstrate knowledge of cross-functional team structures and team members’ roles.
3. Create/evaluate products/services using

requirements.

3 2 1 0 3. Assess the importance of new

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **that are not available in other courses and** | reliability factors. | 3 2 1 0 | 7. | Use freehand graphic |
| **should be enumerated in addition to those** e.Identify testing methodologies,  **listed below.** and system analysis  Possible topics (you will have others): | | | | communication skills to represent  conceptual ideas, analysis, and |
| design concepts. |

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).

# 21007 Engineering Design & Development

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 2 1 0 | 1. | Calculate the required equipment  and materials for mechanical |  | |
| 3 2 1 0 | 2. | construction applications.  Apply conventional construction | 3 2 1 0 | 13. |
|  |  | measurement processes accurately |  |  |
|  |  | (geometric and trigonometric  functions). | 3 2 1 0 | 14. |
| 3 2 1 0 | 3. | Know significant historical |  |  |
|  |  | architectural and structural projects |  |  |
| 3 2 1 0 | 4. | and their effects on society.  Understand the development of | 3 2 1 0 | 15. |
|  |  | architectural and structural systems |  |  |

in relation to aesthetics, efficiency, and safety.

3 2 1 0 5. Understand the ways in which

sociocultural conditions and issues influence architectural design.

3 2 1 0 6. Understand the theoretical and

practical effects of human and physical factors as well as cost analysis on the development of architectural designs.

3 2 1 0 8. Understand the integration of

architectural factors, such as soil mechanics, foundation design, engineering materials, and structure design.

3 2 1 0 9. Understand stress-strain

relationships of building structures. 3 2 1 0 10. Know historical and current events that have relevance to engineering

design.

3 2 1 0 11. Understand the development of graphic language in relation to engineering design.

3 2 1 0 12. Understand the process of

producing proportional two- and three-dimensional sketches and designs

Use sketching techniques as they apply to a variety of architectural and engineering models.

Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.

Develop a binder of representative student work for presentation.

3 2 1 0 16. Use methods and techniques for employing all engineering design equipment appropriately.

3 2 1 0 17. Apply conventional engineering

design processes and procedures accurately, appropriately, and safely

3 2 1 0 18. Apply the concepts of engineering design to the tools, equipment, projects, and procedures of the Engineering Design Pathway.

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|  |  | proper dimensioning styles for each. | 3 2 1 0 1. | Recognize different resource types | 3 2 1 0 | 18. | Survey strategies for critical path |
| 3 2 1 0 | 32. | Apply dimensioning to various objects and features. |  | (Work, Material, Cost, Budget,  Personnel/Skills, Generic, etc) | 3 2 1 0 | 19. | scheduling.  Create strategies to manage project |
|  |  |  |  |  |  |  | budgets. |

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| 3 2 1 0 | 19. | Know how the various measurement systems are used in | 3 2 1 0 | 33. | Edit a dimension by using various editing methods. | 3 2 1 0 | 2. | Understand the concept of scope and demonstrate in context of |
|  |  | engineering drawings. | 3 2 1 0 | 34. | Understand the function of |  |  | assessing the size of a project. |
| 3 2 1 0 | 20. | Understand the degree of accuracy |  |  | sectional views. | 3 2 1 0 | 3. | Develop plans for project |
|  |  | necessary for engineering design. | 3 2 1 0 | 35. | Use a sectional view and |  |  | management and resource |
| 3 2 1 0 | 21. | Understand the commands and  concepts necessary for producing |  |  | appropriate cutting planes to clarify  hidden features of an object. | 3 2 1 0 | 4. | scheduling.  Identify key personnel and |
|  |  | drawings through traditional or | 3 2 1 0 | 36. | Understand what constitutes |  |  | responsibilities for project. |
|  |  | computer-aided means. |  |  | mating parts in engineering design. | 3 2 1 0 | 5. | Develop SWOT analysis [Strengths, |
| 3 2 1 0 | 22. | Understand the orthographic  projection process for developing | 3 2 1 0 | 37. | Use tolerancing in an engineering  drawing. |  |  | Weaknesses, Opportunities, and  Threats] for project. |
|  |  | multi-view drawings. | 3 2 1 0 | 38. | Interpret geometric tolerancing | 3 2 1 0 | 6. | Analyze workload of tasks and |
| 3 2 1 0 | 23. | Understand the various techniques |  |  | symbols in a drawing. |  |  | projects. |
| 3 2 1 0 | 24. | for viewing objects.  Use the concepts of geometric | 3 2 1 0 | 39. | Understand the processes of  lettering and text editing. | 3 2 1 0 | 7. | Determine required personnel  groups and management hierarchy. |
|  |  | construction in the development of | 3 2 1 0 | 40. | Develop drawings using notes and | 3 2 1 0 | 8. | Determine resources necessary for |
|  |  | design drawings. |  |  | specifications. |  |  | project completion. |
| 3 2 1 0 | 25. | Apply pictorial drawings derived  from orthographic multi-view | 3 2 1 0 | 41. | Understand the methods of title  block creation. | 3 2 1 0 | 9. | Determine essential tasks necessary  for project completion. |
|  |  | drawings and sketches and from a | 3 2 1 0 | 42. | Apply conventional engineering | 3 2 1 0 | 10. | Design potential timelines for |
|  |  | solid modeler. |  |  | technology processes and |  |  | assignments. |
| 3 2 1 0 | 26. | Understand the commands and  concepts necessary for editing |  |  | procedures accurately,  appropriately, and safely. | 3 2 1 0 | 11. | Explore appropriate technologies  for project management and |
|  |  | engineering drawings. | 3 2 1 0 | 43. | Choose between alternate solutions |  |  | resource scheduling. |
| 3 2 1 0 | 27. | Know the various object-altering |  |  | in solving a problem and be able to | 3 2 1 0 | 12. | Create and present a project |
| 3 2 1 0 | 28. | techniques.  Know the CADD components and |  |  | justify the choices made in  determining a solution. |  |  | management and resource  scheduling plan. |
|  |  | the operational functions of CADD | 3 2 1 0 | 44. | Build a prototype from plans and | 3 2 1 0 | 13. | Create Gantt charts. |
|  |  | systems. |  |  | test it. | 3 2 1 0 | 14. | Evaluate and assign resources to |
| 3 2 1 0 | 29. | Apply two-dimensional and three-  dimensional CADD operations in | 3 2 1 0 | 45. | Calibrate and measure objects by  using precision measurement tools | 3 2 1 0 | 15. | tasks.  Implement project management |
|  |  | creating working and pictorial |  |  | and instruments. |  |  | skills to design and complete a |
|  |  | drawings, notes, and notations. |  |  |  |  |  | collaborative project. |
| 3 2 1 0 | 30. | Understand how to determine 3 2 1 0 16. Learn various survey strategies to  properties of drawing objects. **21205 Project Management and** track project progress. | | | | | | |
| 3 2 1 0 | 31. | Know a variety of drafting **Resource Scheduling** 3 2 1 0 17. Develop strategies for monitoring | | | | | | |
|  |  | applications and understand the interconnected assignments. | | | | | | |

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| 3 2 1 0 20. Build survey analysis for customer | 3 2 1 0 | 17. Identify a control system and | 3 2 1 0 | 1. Summarize the components of |
| satisfaction |  | explain its application to |  | effective communication. |

# 21010 Computer Integrated Manufacturing

3 2 1 0 1. Utilize the computer to process materials records.

3 2 1 0 2. Maintain accurate written records of project materials.

3 2 1 0 3. Use the computer to produce written materials as needed.

3 2 1 0 4. Maintain written records

documenting progress.

3 2 1 0 5. Convert fractions into decimal equivalents.

3 2 1 0 6. Convert English system

measurements into metric measurements.

3 2 1 0 7. Demonstrate the operation of micrometers.

3 2 1 0 8. Interpret micrometer reading measurements.

3 2 1 0 9. Demonstrate the operation of calipers.

3 2 1 0 10. Interpret caliper reading measurements.

3 2 1 0 11. Demonstrate knowledge of safety concerning CIM/CNC tools, machines, and materials.

3 2 1 0 12. Demonstrate appropriate care of CIM/CNC tools, equipment, materials, and facilities.

3 2 1 0 13. Draw a blueprint/working

drawing of an assigned product. 3 2 1 0 14. Identify basic flowcharting

symbols and discuss their functions. 3 2 1 0 15. Create a flowchart that portrays

a manufacturing process.

3 2 1 0 16. Apply flowcharting to areas other than manufacturing.

manufacturing.

3 2 1 0 18. Model and create a program to control an automated system.

3 2 1 0 19. Produce various products from blueprint/working drawings.

3 2 1 0 20. Produce a product using a

multiple step method of machining. 3 2 1 0 21. Transfer drawings made in CAD

to a CAM program.

3 2 1 0 22. Read and interpret G & M

codes.

3 2 1 0 23. Generate CNC code.

3 2 1 0 24. Calculate feed rate, cutting

speed, chip thickness for various materials on a mill or lathe.

3 2 1 0 25. Demonstrate proper setup

procedures for operating a CNC milling or turning machine.

3 2 1 0 26. Power up and power down the computer and equipment appropriately to calibrate and prepare for use.

3 2 1 0 27. Utilize the computer and CNC software to run a part program.

3 2 1 0 28. Use the computer and CNC

machine to produce a product. 3 2 1 0 29. Describe the changes from

manual machining to computer numerical control machining.

3 2 1 0 30. Describe advantages and

disadvantages of CNC machining.

# 21020/21014 BioEngineering or Biotechnical Engineering

## Biotechnical Engineering Procedures

3 2 1 0 2. List the forms of documentation needed for effective communication.

3 2 1 0 3. Outline the steps necessary to keep one’s self safe in a laboratory setting.

3 2 1 0 4. Relates what could happen to experiment results if measurement is performed or recorded incorrectly.

3 2 1 0 5. Distinguishes the difference between accuracy and precision

3 2 1 0 6. Explains how both accuracy and precision play a vital role in the design process

## Biotechnical Engineering History and Industry

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

3 2 1 0 8. Illustrate the major biotechnical engineering milestones using a wide variety of internet resources.

3 2 1 0 9. Assess the impact of each milestone based on their research.

3 2 1 0 10. Identify the fundamental concepts common to all major industries in biotechnical engineering.

3 2 1 0 11. Identify and explain how biotechnical engineered products impact society.

3 2 1 0 12. Predict future developments in biotechnical engineering.

3 2 1 0 13. Investigate the relationship between financial markets and scientific research

## Values and Ethics

3 2 1 0 14. Distinguish between values and morals.

3 2 1 0 15. Identify some of the parameters that shape an individual’s ethics.

3 2 1 0 16. Discuss bioethics.

3 2 1 0 17. Explain why it is important to consider the bioethical issues of technological advancements.

3 2 1 0 18. Outline the steps that might be used in determining the societal and environmental ramifications of biotechnology research.

3 2 1 0 19. Explain why it is important to keep an open mind to different perspectives in biotechnical research

## Bioinformatics

3 2 1 0 20. Summarize the molecular techniques that are used by bioinformaticists.

3 2 1 0 21. Create a portfolio demonstrating the research and integration of forensics with engineering.

3 2 1 0 22. Illustrate the process necessary for creating a fuming chamber for lifting prints from evidence.

3 2 1 0 23. Analyze the technology utilized in the field of forensics.

3 2 1 0 24. Apply knowledge of genetic engineering to the design of a novel and beneficial application of the reporter gene, green fluorescent protein.

3 2 1 0 25. Describe how to isolate proteins.

## Fermentation

3 2 1 0 26. Describe the applications of fermentation in food production and renewable energy.

3 2 1 0 27. Design a method or instrumentation to be used for measuring rates of fermentation.

3 2 1 0 28. Explain what variables affect CO2 production in yeast in order to determine the ideal conditions for fermentation.

## Biomedical Engineering

3 2 1 0 29. Demonstrate the application of engineering principles by improving upon existing hospital designs or surgical equipment designs.

3 2 1 0 30. Explain the concepts of product liability, product reliability, product reusability and product failure.

## Orthopedics

3 2 1 0 31. Identify anatomical joint features and movements.

3 2 1 0 32. Design a joint model with the same degrees of freedom as the human counterpart.

3 2 1 0 33. Synthesize skeletal system concepts with the design process for engineering joints.

## Cardiovascular Devices and Imaging

3 2 1 0 34. Summarize the most common forms of heart disease and disorders..

3 2 1 0 35. Explain procedures involving artificial heart surgery.

3 2 1 0 36. Estimate the cost of a proposed noninvasive implant.

## 3 2 1 0 37. Design a portable ECG monitor and study the electrical aspects associated with the heart.

**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

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|  | solution for an engineering or architecture project. |  | views and communicate their understanding of how elevations |  | modify section details to show the sizing of supporting materials. |
| 3 2 1 0 | 8. Students will communicate |  | are used in the design of the | 3 2 1 0 | 28. Students will research the |
|  | understandings of the relationship |  | project’s structures. |  | various foundation types, draw |
|  | of structures and land and the | 3 2 1 0 | 18. Students will draw the exterior |  | sketches of each one, and describe |
|  | responsibility of designers to handle  resources in an ethical manner. | 3 2 1 0 | and interior elevations.  19. Students will compare and | 3 2 1 0 | their use.  29. Students will prepare a |
| 3 2 1 0 | 9. Students will conduct a survey of |  | contrast sections and details |  | foundation detail. |
|  | their personal residence and write |  | explaining their purposes in a set of |  |  |
|  | their observations about the |  | architectural plans. |  |  |

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 re design an appropriate | search and energy |
| system.  3 2 1 0 16. Students will ca determine the heat | lculate and 3 2 1 0 loss or gain of |
| the energy systems.  3 2 1 0 17. Students will co | mpare and 3 2 1 0 |

contrast the various elevations

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.

* 1. Students will determine the strength of columns and beams required for a structure.
  2. Students will size floor members according to loads and

# 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 civil engineering.

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 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

to develop a viable solution for an engineering project.

3 2 1 0 8. Students will communicate

understandings of the relationship

# 21013 Aerospace Engineering

## History of Flight

1. Students will demonstrate basic knowledge of aerodynamics and physics.
2. Students will utilize the design process, with computer simulation

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|  | using various drawing methods, develop two and three dimensional | 3 2 1 0 | 15. Students will identify the regions of the United States that are | 3 2 1 0 |
| sketches, graphics, or other media |  | susceptible to seismic loads. |  |
| (including computer assisted media) | 3 2 1 0 | 16. Students will research the | 3 2 1 0 |
| collected and documented. |  | different types of loads acting on a |  |
| 3 2 1 0 | 7. Students will communicate the  current common practices utilized |  | structure and write a brief  description with a diagram in their | 3 2 1 0 |
|  | in civil engineering and apply them |  | journals/notebooks. |  |

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

## Airfoil Construction

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

3 2 1 0 2. Students create sub-scale models used

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| of structures and land and the  responsibility of designers to handle | | 3 2 1 0 | 1. Students will construct a PowerPoint  that shows knowledge of the history | 3 2 1 0 | 3. | to represent a full-size system.  Students will apply coordinate |
| resources in an ethical manner. of flight. geometry to create varied shapes | | | | | | |
| 3 2 1 0  3 2 1 0 | 1. Students will develop and be able to read a contour map. 2. Students will utilize site geography to appropriately place buildings, allow for drainage, | 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 | 3 2 1 0 | 4. | used to design an airfoil.  Students will select appropriate hand tools and equipment, and operate tools and equipment selected to create accurate scale models. |
| provide aesthetic appeal and atmosphere and space. **Wind Tunnel Testing** | | | | | | |
|  | moderate external climate (utilizing vegetation and landform) and provide for adequate access and | 3 2 1 0 | 3. Students will list many types of  vehicles that have been designed to fly. | 3 2 1 0  3 2 1 0 | 1. Students will compare and contrast prototypes of auxiliary models. 2. Students will use scale models to | |
| 3 2 1 0 | parking.  11. Students will examine and assess the pros and cons of local, | 3 2 1 0 | 4. Students shall identify the major  components of airplanes which has a specific function in the design and | 3 2 1 0 | evaluate, to test, and to determine the performance of aircraft designs.  3. Students will use the wind tunnel to | |

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.

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

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

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

graph, display, evaluate and analyze test data.

## Glider Design & Construction

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

3 2 1 0 2. Students predict the flight

performance of an aircraft utilizing the mathematics of flight theory.

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

3 2 1 0 4. The student will collect and use flight testing data to evaluate an aircraft design.

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| 3 2 1 0 5. Students will construct multiple designs capable of achieving similar | 3 2 1 0 | 4. Students formulate a research question based on research, gathering |  |  | designing solutions to problem in aerospace engineering |
| results. |  | data, analyzing data, and making | 3 2 1 0 | 3. | Students discuss how engineers have |
|  | | judgments about experimental data. |  |  | solved many technological challenges |
| **Measuring Rocket Engine Thrust** 3 2 1 0 5. Students use the scale factor of aerial faced when designing solutions for | | | | | |
| 3 2 1 0 1. Rocket thrust is measured using a simple device. | | photographs to determine a rocket's  altitude, number, and kind of objects | 3 2 1 0 | 4. | living higher atmospheres and space.  Students develop a demonstration of |
| 3 2 1 0 2. Students calibrate thrust | | in the photograph, and the dimension |  |  | force, mass, and acceleration |
| measurements | | of objects in the photographs. |  |  | phenomena or G-forces that |
| 3 2 1 0 3. Thrust vs. time data is acquired using a 3 2 1 0 data taking device. | | 6. Students use aerial photographs to  identify, classify, and enumerate |  |  | astronauts, fighter pilots, and Formula  One drivers might experience. |

## Model Rocket Trajectory

objects in the photograph.

## Effect of Gravity on the Human Body

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| --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 1. Parts of a model rocket and parts of a 3 2 1 0 7. Students understand that a rocket's 3 2 1 0 | | | | | 1. | Students simulate a 1-g, Earth-normal, |
| model rocket engine are identified by the student. | |  | launch angle affects the forces of lift,  thrust, weight, and drag. | 3 2 1 0 | 2. | environment  Students simulate the action of |
| 3 2 1 0 2. Students understand and explain how **Orbital Mechanics** spinning and how it can fool the | | | | | | |
|  | the forces of weight, thrust, drag, and  lift interact differently on a rocket in flight. | 3 2 1 0 | 1. Students create drawings to show that  ellipses are conic sections, and circles are special cases of ellipses. | 3 2 1 0 | 3. | senses and stimulate the vestibular  system in the inner ear.  Students work in cooperative and |
| 3 2 1 0 | 3. Students state how Newton's three laws of motions (inertia, F- ma, and action- reaction) can be used to describe and predict events during | 3 2 1 0 | 2. 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 | 4. | supportive teams to simulate how  theses behaviors result in increased safety and higher quality data.  Students investigate and give |
|  | each phase of a rocket launch. | 3 2 1 0 | 3. Students calculate to show that an |  |  | examples of how a stress-filled |
| 3 2 1 0 | 4. Rockets are designed with features |  | object in orbit is continuously "falling" |  |  | environment is physically unique and |
|  | that are interrelated. |  | toward the body about around which |  |  | can affect the ability to perform |
| 3 2 1 0 | 5. The student will calculate the |  | they orbit. |  |  | mental functions. |
| 3 2 1 0 | maximum velocity and maximum acceleration of a rocket during flight.  6. The student will calculate a rocket's | 3 2 1 0 | 4. Students calculate to show that orbital  elements can be used to fully define a satellite's orbit, allowing the accurate | 3 2 1 0  3 2 1 0 | 5.  6. | Students identify common equipment  that can be used for data acquisition. Students use spreadsheet software to |
|  | maximum altitude by using indirect |  | prediction of the precise location of |  |  | collect, analyze and report data. |

measurement.

## Rocket Camera

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

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

3 2 1 0 3. Students use the scientific method to

the satellite at a given time.

## Life Support & Environmental Systems

3 2 1 0 1. Students describe basic physiological

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| --- | --- |
| needs of the human body when living | 3 2 1 0 |
| safely within and outside of Earth's |  |
| atmosphere. | 3 2 1 0 |

3 2 1 0 2. The students make a model to show

## Microgravity Drop Tower

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

1. Students state the value of "g" on earth.
2. Students demonstrate microgravity 3 2 1 0 4. Students describe the microgravity

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| design and project to answer a | how the environment on earth and in | environment associated with the |
| research question. | space must be considered when | space shuttle |

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| --- | --- | --- | --- | --- | --- | --- |
| 3 2 1 0 5. Students list the types of experiments that can be done in microgravity. | | 3 2 1 0 | 6. Students will test composite materials using a deflection test to evaluate the | 3 2 1 0 | 2. | Students define interactive systems used in science exploration. |
| **Composites Fabrication & Testing** | |  | stiffness of various composite plastic | 3 2 1 0 | 3. | Students will interpret electronic data |
| 3 2 1 0 1. Students test multiple layers of | |  | samples. |  |  | and communication that allows |
| material to determine that they are **Thermal Protection Systems for Vehicles** information to be transferred from | | | | | | |
|  | stronger than a single layer of that  material. | 3 2 1 0 | 1. An understanding of the physics of  space vehicle re-entry into the |  |  | human to human, human to machine,  machine to human, and machine-to- |
| 3 2 1 0 | 2. Students describe the composition of |  | atmosphere is used by the students to |  |  | machine. |
|  | composite materials that are |  | design thermal protection systems | 3 2 1 0 | 4. | Students will define the meaning of pH |
|  | fabricated by molding together layers  of reinforced fabric (often glass or | 3 2 1 0 | 2. Students demonstrate knowledge of  material properties and types of | 3 2 1 0 | 5. | values.  Students will describe uses for robotic |
|  | carbon fiber) with a plastic matrix, |  | testing when trying to protect a space |  |  | devices. |
|  | such as epoxy. |  | vehicle. | 3 2 1 0 | 6. | Students will list robotic devices that |
| 3 2 1 0 | 3. Students describe how composite  materials are used in the aerospace | 3 2 1 0 | 3. Students describe the heat transfer  process that creates high |  |  | are composed of mechanical,  electrical, and computer based |
|  | industry |  | temperatures in a space vehicle. |  |  | systems that can be programmed to |
| 3 2 1 0 | 4. Students determine how the strength | 3 2 1 0 | 4. Thermal Protection Systems (TPS) are |  |  | make decisions and control actions |
|  | and stiffness of composite materials |  | described by the students. |  |  | based upon sensor readings. |
|  | can be significantly increased. | **Intelligent Vehicles** | | 3 2 1 0 | 7. | Students will construct a robot device |
| 3 2 1 0 | 5. The student will assess material | 3 2 1 0 1. Students will evaluate incentives for | |  |  | that performs a task. |
|  | performances by comparing strength | building robots. | |  |  |  |
|  | to weight ratios. |  | |  |  |  |