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 CAREER CLUSTER DESIGN

Engineering & Applied Mathematics Pathway – CIP Code 14.0101

INTRODUCTORY LEVEL

ΦPrinciples of Tech. (8-9)	53153/03153	1 credit	ΦPre-Engineering Tech. (8-9)	21001/71001	1 credit
Computing Systems (8-9)	10002/60002	1 credit	✪ Engineering Appl. (8-9)	21002/71002	1 credit
Computer Appl. (8-9)	10004/60004	1 credit	Φ✪ Engineering Tech. (8-9)	21003/71003	1 credit
Blueprint Reading	21108	.5 credit			

TECHNICAL LEVEL

Φ✪ Prin. Of Engineering	21004	1 credit	ΦEngineering-Comprehensive	21005	1 credit
Φ✪ Engineering Design	21006	1 credit	Foundations of Electronics	21201	1 credit
Robotics	21009	1 credit			
Advanced Production Blueprint Reading	39108	.5 credit	ΦTechnical Innovation and Assessment	21054	1 credit

APPLICATION LEVEL

✪Course appropriate for Project Lead the Way Programs;

Emerging Technologies	21053	1 credit	Materials Science & Engineering	21252	1 credit
✪Digital Electronics	21008	1 credit	✪Civil Eng. & Architecture or	21012	1 credit
Φ✪Computer Integrated Manufacturing	21010	1 credit	Civil Engineering	21011	1 credit
✪BioEngineering or	21020	1 credit	✪Aerospace Engineering	21013	1 credit
✪Biotechnical Engineering	21014	1 credit	Particular Topics in Engineering	21015	1 credit
Project Mgmt & Resource Scheduling	21205	1 credit	Φ✪Eng. Design & Development	21007	1 credit
			Workplace Experience	21048	1 credit

competencies may be utilized by any/all schools.

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

KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE

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

STUDENT_____

Rating Scale:

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

ENGINEERING CLUSTER

Graduation Date _____

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

Instructor Signature _____

Instructor Signature _____

Instructor Signature _____

Instructor Signature _____

COMMON CAREER TECHNICAL CORE – CAREER READY STANDARDS

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

COMMON CAREER TECHNICAL CORE – STEM CLUSTER STANDARDS

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

INTRODUCTORY LEVEL COURSES

03153 Principles of Technology

3 2 1 0 1. The student works safely with mechanical, fluid, electrical, and thermal technology.
   a. Student will master relevant safety tests
   b. Student will follow safety manuals, instructions, and requirements
   c. Student will make prudent choices in the conservation and use of resources and the disposal of materials
   d. Student will appropriately utilize laboratory equipment to accomplish activities of lesson
   e. 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.
   a. Student will apply the universal

systems model to technological activities; and

b. Student will identify the inputs, processes, outputs, and feedback associated with each of the systems.

3 2 1 0 3. The student knows the laws governing motion.

a. Student will analyze examples of uniform and accelerated motion, including linear, projectile, and circular motion;

b. Student will generate and interpret graphs describing motion, including the use of real time technology;

c. Student will formulate the effects of forces on the motion of objects;

d. Student will develop and interpret a free-body diagram for force analysis; and

e. Student will identify and describe motion related to different frames of reference.

3 2 1 0 4. The student knows the concept of force.

a. Student will apply examples complex technological devices where force must be controlled, measured or applied;

b. Student will analyze the relationship among force, pressure, voltage, and temperature;

c. Student will evaluate and predict what happens to an object when forces on it are balanced and when forces on it are unbalanced; and

d. Student will measure force in mechanical, fluid, electrical, and thermal systems.

3 2 1 0 5. The student knows the concept of work.

a. Student will relate mechanical, fluid, and electrical to force and movement; and

b. Student will identify and measure the effects of work done in mechanical, fluid and electrical systems.

3 2 1 0 6. The student knows the concept of rate.

a. Student will analyze rate in mechanical, fluid, electrical, and thermal systems; and

b. Student will measure, verify, and analyze rate in mechanical, fluid, electrical, and thermal systems.

3 2 1 0 7. Student knows electrical systems concepts.

a. Student will identify and recreate basic series and parallel circuits

b. Students will appropriately utilize symbols on blueprints and charts related to electrical systems

c. 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.

a. Student will identify resistance in mechanical, fluid, electrical, and thermal energy systems

b. Student will relate the principle of force divided by rate to resistance in each energy system

c. Student will measure, verify, and analyze resistance in mechanical, fluid, electrical, and thermal energy systems.

3 2 1 0 9. The student knows the concept of energy.

a. Student will identify the nature of energy;

b. Student will relate potential energy, kinetic energy, and heat energy to the conservation of energy;

c. Student will distinguish between work and energy;

d. Student will measure, verify, and analyze energy in each system; and

e. Student will evaluate different methods of energy transfer that result in an increasing amount of disorder.

3 2 1 0 10. The student knows the concept of power.

a. Student will define power in mechanical, fluid, electrical, and 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.

a. Student will observe and describe examples of kinetic and potential energy in mechanical, fluid, and electrical systems

b. 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

Students will:

Communication and interpretation of information in industry-standard formats:

3 2 1 0 1. Understand the classification and use of various components, symbols, abbreviations, and media common to electronic and mechanical drawings.

3 2 1 0 2. Understand, organize, and complete an assembly drawing by using information collected from detailed drawings.

3 2 1 0 3. Know the current industry standards for illustration and layout.

3 2 1 0 4. Draw flat layouts of a variety of objects by using the correct drafting tools, techniques, and media

3 2 1 0 5. Prepare reports and data sheets for writing specifications.

Concepts of physics fundamental to engineering technology:

3 2 1 0 6. Understand Newton's laws and how they affect and define the movement of objects.

3 2 1 0 7. Understand how the laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.

3 2 1 0 8. Analyze the fundamentals and properties of waveforms and how waveforms may be used to carry energy.

3 2 1 0 9. Understand how electric and magnetic phenomena are related and know common practical applications.

Fundamentals of electrical energy:

3 2 1 0 10. Analyze relationships between voltage, current, resistance, and power related to direct current (DC) circuits.

3 2 1 0 11. Understand the characteristics of alternating current (AC) and how it is generated; the characteristics of the sine wave; the basic characteristics of AC circuits, tuned circuits, and resonant circuits; and the nature of the frequency spectrum.

3 2 1 0 12. Calculate, construct, measure, and employ both AC and DC circuits.

3 2 1 0 13. Use appropriate electronic instruments to analyze, repair, or measure electrical and electronic systems, circuits, or components.

3 2 1 0 14. 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 15. Classify and use various electrical components, symbols, abbreviations, media, and standards of electrical drawings.

3 2 1 0 16. Understand how electrical control and protection devices are used in electrical systems.

3 2 1 0 17. Calculate loads, currents, and circuit-operating parameters.

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

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 their applications.

3 2 1 0 21. Know how energy is transferred; know the effects of resistance in mechanical, electrical, fluid, and thermal systems.

3 2 1 0 22. Solve problems by using the appropriate units applied in mechanical, electrical, fluid, and thermal engineering systems.

Utilizing the design process to analyze and solve design problems:

3 2 1 0 23. Understand the steps in the design process.

3 2 1 0 24. Determine what information and principles are relevant to a problem and its analysis.

3 2 1 0 25. Choose between alternate solutions in solving a problem and be able to justify the choices made in determining a solution.

3 2 1 0 26. Translate word problems into mathematical statements when appropriate.

3 2 1 0 27. Develop a solution from multiple details provided by client.

3 2 1 0 28. Build a prototype from plans and test it.

3 2 1 0 29. Evaluate and redesign a prototype on the basis of collected test data.

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

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

cycle.

3 2 1 0 31. Understand the major manufacturing processes.

3 2 1 0 32. Use tools, fasteners, and joining systems employed in selected engineering processes.

3 2 1 0 33. Estimate and measure the size of objects in both Standard International and United States units.

3 2 1 0 34. Calibrate and measure objects by using precision measurement tools and instruments.

Computer systems and engineering perspective:

3 2 1 0 35. Understand how to design systems that use computer programs to interact with hardware.

3 2 1 0 36. Know the function and interaction of basic computer components and peripherals.

3 2 1 0 37. Install and configure computer hardware and software components required for solution.

3 2 1 0 38. Understand the relationship among computer hardware, networks, and operating systems.

3 2 1 0 39. Understand the process of testing and troubleshooting computer equipment and systems.

3 2 1 0 40. Test and maintain wireless and wired communications components 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 display data in a simulated or modeled automated system.

3 2 1 0 43. Understand the use of sensors for data collection and process correction in an automated system.

3 2 1 0 44. Program a computing device to control an automated system or process.

3 2 1 0 45. Use motors, solenoids, and similar devices as output mechanisms in automated systems.

3 2 1 0 46. Assemble input, processing, and output devices to create an automated system capable of accurately completing a preprogrammed task.

Fundamentals of systems and products in phases of development, production, and marketing:

3 2 1 0 47. Understand the process of product development.

3 2 1 0 48. Understand project management, charting, and the use of graphic tools in illustrating the development of a product and the processes involved.

21002 Engineering Applications

Design and Modeling

3 2 1 0 1. Explain the relationship between science, technology, engineering and math.

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

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

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

3 2 1 0 5. Assemble an engineering notebook and a portfolio.

3 2 1 0 6. Describe the design process and how it is used to aid in problem solving.

3 2 1 0 7. Use the design process to solve a technical problem.

3 2 1 0 8. Recognize design criteria and constraints.

3 2 1 0 9. Describe the purpose and importance of working in a team.

3 2 1 0 10. Explain a design brief and apply the concept when using the design process.

3 2 1 0 11. Describe the elements of design and apply this concept to the design process.

3 2 1 0 12. Use a decision matrix to select the best solution to a design problem.

3 2 1 0 13. Demonstrate the ability to measure accurately with different devices and scales.

3 2 1 0 14. Explain how to measure in different contexts.

3 2 1 0 15. Measure using both the English and Metric systems.

3 2 1 0 16. Summarize the reasoning for using sketching as a communication tool.

3 2 1 0 17. Use visualization, spatial reasoning, and geometric shapes to sketch two and three dimensional shapes.

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

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

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

methods, notes, and drafting views.

Dimension an orthographic sketch following the guidelines of dimensioning.

3 2 1 0 22. Create a three-dimensional (3D) model of an object.

3 2 1 0 23. Apply geometric and dimension constraints to design CAD-modeled parts.

3 2 1 0 24. Assemble the product using the CAD modeling program.

3 2 1 0 25. Demonstrate the ability to produce various annotated working drawings of a 3D model.

3 2 1 0 26. Identify the difference between a prototype, a model and a mock-up and analyze what circumstances call for the use of each.

3 2 1 0 27. Explain why teams of people are used to solve problems.

3 2 1 0 28. Brainstorm and sketch possible solutions to an existing design problem.

3 2 1 0 29. Create a decision-making matrix.

3 2 1 0 30. Select an approach that meets or satisfies the constraints given in a design brief.

Automation and Robotics

3 2 1 0 31. Describe the purpose of automation and robotics and its effect on society.

3 2 1 0 32. Summarize ways that robots are used in today's world and the impact of their use on society.

3 2 1 0 33. Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.

3 2 1 0 34. Investigate a career related to automation and robotics and determine the requirements for entering the field.

3 2 1 0 35. Investigate and understand various mechanisms to determine their purpose and applications.

3 2 1 0 36. Be able to apply their knowledge of mechanisms to solve a unique problem.

3 2 1 0 37. Design, build, wire, and program both open and closed loop systems.

3 2 1 0 38. Troubleshoot a malfunctioning system using a methodical approach.

3 2 1 0 39. Experience fluid power by creating and troubleshooting a pneumatic device.

3 2 1 0 40. Design, build, wire and program a system operated by alternative energy.

Energy and the Environment (optional/extension)

3 2 1 0 41. Differentiate between potential and kinetic energy.

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

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

- Efficiency vs. Conservation and measures to address each
- Water Conservation and Management
- Energy Budget and Fiscal Impact
- Geographic Barriers and Availability Considerations of Resources
- Power, Work, and Measure of Energy
- Trends of Consumption of Various Energy Sources
- Environmental Impact of Energy Usage and Disposal

21003 Engineering Technology

Flight and Space

3 2 1 0 1. Apply their knowledge of research techniques to investigate the history of an aerospace vehicle.

3 2 1 0 2. Experience the flight characteristics of kites, whirly gigs, model airplanes, hot air balloons, and model rockets.

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

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

3 2 1 0 5. Examine how center of gravity affects an aerospace vehicle in distributing weight.

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

3 2 1 0 7. Discover Bernoulli's principle through exploration.

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

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

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

3 2 1 0 11. Describe the major parts (fuselage, empennage, high lift devices, wings, undercarriage, propulsion, instruments, and controls) of aircraft and how they can affect the overall balance of an airplane during flight.

3 2 1 0 12. Research and design an airfoil and empennage for use in the prototyping of a Styrofoam glider.

3 2 1 0 13. Explore the history and development of rocketry, space flight, and living in space.

3 2 1 0 14. Discover the basic principles of flight and rocketry.

3 2 1 0 15. Investigate how changes in various design characteristics of a rocket will affect the rocket's performance.

3 2 1 0 16. Know that a rocket must overcome the forces of gravity and drag in order to get out of the atmosphere.

3 2 1 0 17. Understand that an orbit is the balance of gravity and an object's tendency to follow a straight path.

3 2 1 0 18. Use an immersive learning simulation to select optimal components for a lunar robot's engine, power source, tires, body type and sensor system to save stranded astronauts on the moon.

3 2 1 0 19. Understand the challenges that engineers face to provide safe travel and optimum living conditions in space.

Science of Technology

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

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

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

3 2 1 0 23. Work with a team to solve an oil spill engineering simulation problem.

3 2 1 0 24. Demonstrate an understanding of how small a nanometer is.

3 2 1 0 25. Explore how nano-products are used in society today.

3 2 1 0 26. Identify tools and processes used to see and manipulate matter at the nanoscale.

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

3 2 1 0 28. Correctly identify the six simple machines and explain their applications.

3 2 1 0 29. Distinguish between the three classes of levers.

3 2 1 0 30. Identify a machine as something that helps use energy more efficiently.

3 2 1 0 31. Determine mechanical advantage from assembled simple machines.

3 2 1 0 32. Be able to compare and contrast kinetic and potential energy.

3 2 1 0 33. Predict the relative kinetic energy based on the mass and speed of the object.

3 2 1 0 34. Recognize and follow safety rules for using lab tools and machines.

3 2 1 0 35. Build, test, and evaluate a model of a design problem.

3 2 1 0 36. Analyze a product through testing methods and make modifications to the product.

Magic of Electrons

3 2 1 0 37. Identify the roles of protons, neutrons, and electrons in an atom.

3 2 1 0 38. Identify an element based on the atomic number.

3 2 1 0 39. Identify metals, metalloids, and non-metals on the periodic table.

3 2 1 0 40. Judge whether a material is a conductor, insulator, or semiconductor based upon its number of valance electrons and its position on the periodic table.

3 2 1 0 41. Explain how the Law of Charges holds an atom together.

3 2 1 0 42. Explain how electrons transfer from one atom to another to create electron flow.

3 2 1 0 43. Define current, voltage, and resistance.
3 2 1 0 44. Measure voltage and current using a multimeter.
3 2 1 0 45. Understand the properties of a magnet.
3 2 1 0 46. Build an electromagnet to demonstrate its characteristics and functions.
3 2 1 0 47. Build a DC motor to identify the primary parts and demonstrate how it functions.
3 2 1 0 48. Build a generator to identify the primary parts and demonstrate how it functions.
3 2 1 0 49. Understand the role of an electromagnet in the function of a DC motor and generator.
3 2 1 0 50. Compare the characteristics of a basic motor and generator.
3 2 1 0 51. Build series, parallel, and combination electrical circuits.
3 2 1 0 52. Create circuit diagrams using standardized schematic symbols.
3 2 1 0 53. Build and test physical electrical circuits based upon circuit diagrams.
3 2 1 0 54. Integrate DC sources, lamps, switches, diodes, light emitting diodes, resistors, and capacitors into electrical circuits to achieve specific functions.
3 2 1 0 55. Distinguish between the functions and operations of fixed resistors, variable resistors, and photo resistors.
3 2 1 0 56. Determine the value of a fixed resistor based upon the color codes on those resistors.
3 2 1 0 57. Measure voltage, current, and resistance using a multimeter.
3 2 1 0 58. Mathematically calculate voltage, current, and resistance using Ohm's law.
3 2 1 0 59. Create a circuit that uses a transistor as a switch.
3 2 1 0 60. Interpret logic scenarios to determine outputs based upon possible conditions within those scenarios.
3 2 1 0 61. Distinguish between the functions of NOT, AND, OR, NAND, NOR, and XOR gates.
3 2 1 0 62. Create truth tables for logic scenarios and match those gates to truth tables.
3 2 1 0 63. Convert binary numbers to Base-10.
3 2 1 0 64. Convert ACII characters to binary.
3 2 1 0 65. Create a digital wave form and graph it for a binary sequence.
3 2 1 0 66. Communicate using electronic circuit diagrams.
3 2 1 0 67. Use transistors as switches to create circuits that function as AND and OR gates.
3 2 1 0 68. Determine the logic, sensors, gates, outputs, and other components needed to emulate existing electronic devices that utilize logic.
3 2 1 0 69. Design, construct, and test device solutions for emulating common electronic devices that utilize logic.

10004-Computer Applications

3 2 1 0 1. Personal Information Management
- b. word usage, spelling, sentence structure, clarity, email
- c. Demonstrate knowledge of email etiquette.
- d. Send email messages.
- e. Access email attachments.
- f. Attach documents to messages.
- g. Demonstrate knowledge of contamination protection strategies for email.
- h. Save email messages / attachments.

3 2 1 0 2. Research and Internet
- a. Locate information using search engine(s) and Boolean logic.
- b. Navigate web sites using software functions.
- c. Select appropriate search procedures and approaches.
- d. Select search engine(s) to use.
- e. Access business and technical information using the Internet.
- f. Access commercial, government, and education resources.
- g. Evaluate Internet resources (e.g., accuracy of information).
- h. Explore browser features.
- i. Test Internet connection.
- j. Unpack files using compression software.
- k. Bookmark web addresses (URLs).
- l. Navigate web sites using software functions (e.g., Forward, Back, Go To, Bookmarks).
- a. Create calendars/schedules.
- i. Document results.
- j. Create tasks (to-do) list.
- k. Identify PIM applications (MS Outlook, Lotus Notes, and others).
- l. Manage daily/weekly/monthly schedule using applications such as Notes, MS Outlook, etc.
- m. Create and send notes, informal memos, reminder using PIM applications.

n. Create reminder for oneself.
o. Access email messages received.
p. Access email system using login and password functions.
m. Create e-mail messages in accordance with established business standards (e.g., grammar, Access library catalogs on the Internet.
n. Compile a collection of business sites (e.g., finance and investment).
o. Add plug-ins and helpers to the web browser.
p. Archive files.
q. Explore the multimedia capabilities of the World Wide Web.
r. Utilize online tools.
s. Communicate via email using the Internet.
t. Explore collaboration tools.
u. Explore electronic commerce.
v. Explore newsgroups.
w. Compile a collection of business sites (e.g., finance and investment).

3 2 1 0 3. Word Processing and Presentations

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

3 2 1 0 4. Spreadsheets

a. Create spreadsheets.
b. Edit spreadsheets.
c. Print spreadsheets.
d. Retrieve existing spreadsheets.
e. Save spreadsheets.
f. Create charts and graphs from spreadsheets.
g. Group worksheets.
h. Input/process data using spreadsheet functions.
i. Perform calculations using simple formulas.

3 2 1 0 5. Data

a. Enter data using a form.
b. Locate/replace data using search and replace functions.
c. Process data using database functions (e.g., structure, format, attributes, relationships, keys).
d. Perform single- and multiple-table queries (e.g., create, run, save).
e. Print forms, reports, and results or queries.
f. Search a database table to locate records.
g. Sort data using single and multiple field sorts.
h. Verify accuracy of output.
i. Maintain shared database of contact information.
j. Manage daily/weekly/monthly schedule using applications.
k. Participate in virtual group discussions and meetings.
l. Apply basic commands of operating system software.
m. Employ desktop operating skills.
n. Apply appropriate file and disk management techniques.
o. Recognize the need for regular backup procedures.
p. Demonstrate knowledge of central processing unit (CPU) control and architecture.
q. Identify CPU modes of operations.
r. Define the role of memory management in an operating system.
s. Demonstrate knowledge of network operating systems.
t. Demonstrate knowledge of operating system architecture types.

u. Demonstrate knowledge of the commands used to handle tasks in operating systems.
v. Differentiate between microcomputer, minicomputer, and mainframe operating systems.
w. Demonstrate knowledge of the basics of process management.
x. Demonstrate knowledge of the system utilities used for file management.

3 2 1 0 6. Ethics and Security
a. Demonstrate knowledge of potential internal and external threats to security.
b. Assess exposure to security issues.
c. Demonstrate knowledge of virus protection strategy.
d. Ensure compliance with security rules, regulations, and codes.
e. Explore ways to implement countermeasures.
f. Implement security procedures in accordance with business ethics.
g. Maximize threat reduction.
h. Document security procedures.
i. Understand how to follow a disaster plan.
j. Identify sources of virus infections.
k. Understand how to utilize backup and recovery procedures.
l. Understand how to load virus detection and protection software.
m. Maintain confidentiality.
n. Understand how to provide for user authentication (e.g., assign passwords, access level).
o. Understand how to remove viruses.
p. Report viruses in compliance with company standards.
q. Identify the features and benefits of quality planning.
r. Identify the role of quality within the organization.

3 2 1 0 7. History / Quality Assurance
a. Demonstrate knowledge of changes brought about by quality industry leaders in the world.
b. Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs.
c. Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000).
d. Demonstrate knowledge of the standards/requirements for the Baldridge award.
e. Demonstrate knowledge of quality management terminology.

10002 Computing Systems

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

3 2 1 0 2. Clearly document procedures for future use.
a. Document step-by-step installation and configuration procedures.

3 2 1 0 3. Communicate and recognize goal achievement.
a. Communicate goal achievement.
b. Provide recognition for goal achievement.

3 2 1 0 4. Configure systems to provide optimal system interfaces.
a. Apply concepts of privileged instructions and protected mode programming.
b. Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network).
c. Allocate disk space, non-sharable resources, and I/O devices.
d. Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures).
e. Identify standards and issues related to I/O programming and design of I/O interfaces.
f. Define hardware-software interface issues for a computer system.
g. Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic

disk/CD-ROM storage and formats).

3 2 1 0 5. Configure/modify system as needed.

a. Build system software command structures using operating system macro facilities for computer systems.
b. Identify scheduling priority in programming.
c. Identify data requirements.
d. Review automated scheduling software.
e. Secure needed supplies and resources.

3 2 1 0 6. Determine audience and information needs

a. Define research questions.
b. Identify target audience.

3 2 1 0 7. Document procedures and actions.

a. Develop audit trails.

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

a. processor, memory, disk space, communications, printers, monitors).
b. Determine compatibility of hardware and Identify hardware requirements (e.g., software.

3 2 1 0 9. Ensure that software to be installed is licensed prior to performing installation.

a. Verify conformance to licensing agreement.

3 2 1 0 10. Evaluate information systems problem-solving techniques and approaches.

a. Evaluate systems engineering considerations.
b. Identify potential problems in system implementation.
c. Summarize application planning, development, and risk management for information system.
d. Demonstrate knowledge of critical thinking skills and techniques.
e. Demonstrate knowledge of decision-making skills and techniques.
f. Develop a plan using data-oriented techniques.
g. Determine whether prototyping system is feasible.
h. Determine software design process, from specification to implementation.
i. Appraise software process and product life-cycle models.
j. Assess software design methods and tools.

3 2 1 0 11. Evaluate information.

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

3 2 1 0 12. Explain data communications procedures, equipment and media.

a. Demonstrate knowledge of the uses of data communications media.
b. Demonstrate knowledge of the uses of data communications equipment.
c. . Demonstrate knowledge of key communications procedures.

3 2 1 0 13. Explain measurement techniques for increased productivity due to information systems implementation.

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

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

a. Identify new and emerging classes of software.

3 2 1 0 15. Explain the benefits of hosting a web site on a local server vs. at an ISP (Internet Service Provider).

a. Compare the advantages and disadvantages of running your own server vs. using a server provider.

3 2 1 0 16. Explain the differences between local and wide area networks.

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

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

a. Identify how different browsers affect the look of a web page.
b. Demonstrate knowledge of the characteristics and uses of plug-ins.
c. Demonstrate knowledge of the role of browsers in reading files on the World Wide Web (text-only, hypertext).

3 2 1 0 18. Explain the features and functions of web page design software.

a. Compare/contrast the features and functions of software editors available for designing web pages.

3 2 1 0 19. Explain the key functions and applications of software.

a. Demonstrate knowledge of the function and operation of compilers and interpreters.
b. Demonstrate knowledge of widely used software applications (e.g., word processing, database

management, spreadsheet development).

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

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

a. Identify the role the binary system in information systems.

b. Demonstrate knowledge of number systems and internal data representation.

3 2 1 0 21. Gather information.

a. Identify potential sources of information.

b. Gather information from selected print and electronic sources.

c. Conduct interviews with selected human information sources.

d. Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).

e. Target audience/user group as a key information source.

f. Determine priorities for the information that should be gathered.

g. Identify subject-matter experts.

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

a. Identify types of computer storage devices.

b. Identify the hardware associated with telecommunications functions.

c. Identify major hardware components and their functions.

d. Identify the three main classifications of computers (i.e. micro-, mid-range, & mainframe).

3 2 1 0 23. Identify new IT technologies and assess their potential importance and impact on the future.

a. Identify new technologies relevant to information technology.

b. Assess the importance of new technologies to future developments & to future knowledge worker productivity.

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

3 2 1 0 24. Monitor and adjust goals.

a. Obtain support for goals.
b. Provide support for goals.
c. Monitor goal achievement.
d. Adjust goals.

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

a. Run applications/jobs in accordance with processing procedures.

b. Secure needed supplies and resources.

c. Interact with/respond to system messages using console device.

d. Follow log-off and power-down procedure(s).

e. Follow power-up and log-on procedures.

3 2 1 0 26. Perform customization as requested.

a. Customize software to meet user preferences.

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

a. Select appropriate installation options (e.g., default, customized).

b. Configure software to appropriate operating system settings.

c. Configure macros, tools, and packages to accomplish simple organizational and personal tasks.

d. Differentiate between procedures for an upgrade and for a new installation.

e. Differentiate between stand-alone and network installation procedures.

f. Disable/uninstall software that may interfere with installation of new software.

g. Install given application/system software on various platforms in accordance with manufacturer's procedures.

h. Convert data files if required.

i. Verify software installation and operation.

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

a. Access needed help using manufacturers' technical help lines or Internet sites.

b. Formulate new installation procedure if needed.

c. Troubleshoot unexpected results.

d. Set short- and long-term goals for assigned areas of responsibility/accountability.

3 2 1 0 29. Test and maintain products / services.

a. Test products for reliability.

b. Initiate predictive maintenance procedures.

3 2 1 0 30. Troubleshoot computer-driven equipment and machines and access support as needed

a. Test system using diagnostic tools/software.

b. Repair/replace malfunctioning hardware.

c. Reinstall software as needed.

d. Recover data and/or files.

e. Restore system to normal operating standards.

3 2 1 0 31. Understand and employ design and

color principles.

a. Assess the impact of various color harmonies on a two-dimensional picture plan.

b. Demonstrate knowledge of the two-dimensional picture plan.

c. Demonstrate knowledge of the nature of color and color harmonies.

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

e. Demonstrate knowledge of the principles and elements of design and their relationship to each other.

3 2 1 0 32. Understand data communications trends and issues.

a. Identify major current issues in data communications.

b. Identify data communication trends.

c. Demonstrate knowledge of data transmission codes and protocols.

3 2 1 0 33. Understand elements and types of information processing.

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

b. Identify types of processing (e.g., batch, interactive, event-driven, object-oriented).

3 2 1 0 34. Understand functions and interactions of departments within a business.

a. Identify the ways in which organizational functions are interdependent.

b. Define the role of strategic planning in business.

c. Identify types of communication channels (e.g., formal, informal).

d. Demonstrate knowledge of the components of a business plan.

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

a. Demonstrate knowledge of how bandwidths affect data transmission and on-screen image.

3 2 1 0 36. Understand how data is organized in software development.

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

3 2 1 0 37. Understand information organization principles.

a. Demonstrate knowledge of group support technology for common knowledge requirements.

b. Demonstrate knowledge of methods for achieving productivity in knowledge work.

c. Demonstrate knowledge of the information analysis process.

d. Demonstrate knowledge of information technology solutions.

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

a. Consider customer satisfaction in determining product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation).

b. Design product (e.g., using brainstorming, thumbnail sketches, rendering).

3 2 1 0 39. Understand the differences between a client and a server.

a. Differentiate between a client and a server.

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

a. Identify major operating system fundamentals and components.

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

a. Demonstrate knowledge of the range of languages used in software development.

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

a. Define stakeholder relationships (e.g., customers, employees, shareholders, and suppliers).

b. Identify business reporting and information flow.

c. Identify types of business organizations and functions.

3 2 1 0 43. Use available reference tools as appropriate.

a. Access needed information using appropriate reference materials.

b. 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.

a. Access needed information using appropriate reference materials.

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

a. Consider reliability factors (e.g., cost, human, productivity).

b. Achieve reliability through maintainability, good design, design simplification, and design redundancy.

c. Recognize the relationship of maintainability and reliability.

d. Align cost components with quality objectives.

e. 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

appropriate changes in design, circuitry or programming.

3 2 1 0 24. Students will mathematically analyze a simple truss to determine types and magnitude of forces supported in the truss.

3 2 1 0 25. Students will be able to define, describe, and analyze the stresses and forces acting on an object.

3 2 1 0 26. Students will prepare and present a mathematical analysis of a truss design as part of a 5- minute oral presentation about their bridge design.

3 2 1 0 27. Students will explain the use of factors of safety in the design process.

3 2 1 0 28. Students will be able to explain the difference between the area of a cross section of an object and the second moment of the area (Moment of Inertia) and predict the relative strength of one shape vs. another.

3 2 1 0 29. Students will be able to use a computer aided engineering package to analyze a shape.

3 2 1 0 30. Students will explain the effects that stress has on a material and explain how the material will react.

3 2 1 0 31. Students will be able to identify and differentiate the five basic categories of solid engineering materials.

3 2 1 0 32. Students will be able to compare and contrast the physical properties of organic, metals, polymers, ceramics, and composites.

3 2 1 0 33. Students will be able to trace the production of raw material to finished product.

3 2 1 0 34. Students will be able to identify practical applications of each material category to engineered products and processes.

3 2 1 0 35. Students will be able to identify and document the properties of materials.

3 2 1 0 36. Students will be able to design an experiment to identify an unknown material.

3 2 1 0 37. the student will be able to formulate conclusions through analysis of recorded laboratory test data for presentations in the form of charts, graphs, written, verbal, and multi-media formats.

3 2 1 0 38. Students will be able to analyze word problems about forces acting on materials.

3 2 1 0 39 Students will be able to define and state examples of the major categories of Production Processes.

3 2 1 0 40. Students will be able to interpret a drawing and produce a part.

3 2 1 0 41. Students will be able to state the difference between mass and weight.

3 2 1 0 42. Students will be able to utilize a variety of precision measurement tools to measure appropriate dimensions, mass, and weight.

3 2 1 0 43. Students will be able to calculate the mean, median, mode and standard deviation for a set of data and apply that information to an understanding of quality assurance.

3 2 1 0 44. Students will be able to explain the difference between process and product control.

3 2 1 0 45. Students will be able to describe and safely conduct destructive and non-destructive material testing and will be able to use the data collected through these tests to compute and document mechanical properties.

3 2 1 0 46. Students will be able to analyze a product that breaks and be able to explain how the material failed.

3 2 1 0 47. Students will be able to diagram a system and identify the critical components.

3 2 1 0 48. Students will be able to mathematically estimate chance of failure of a system given information on certain components.

3 2 1 0 49. Students will list the causes of failure and be able to propose solutions.

3 2 1 0 50. Students will prepare and defend a position on an ethical engineering dilemma.

3 2 1 0 51. Students will analyze an engineering failure for the purpose of presenting an oral report which identifies causes, damage done, design failures, and other areas where the failure has impacted the environment or society.

3 2 1 0 52. Students will prepare a written report explaining their analysis of an engineering failure.

3 2 1 0 53. Students will be able to explain the difference between distance traveled and displacement

3 2 1 0 54. Students will design and build a device for the purpose of conducting experiments of acceleration, displacement, and velocity.

3 2 1 0 55. Students will be able to explain how velocity and acceleration are calculated.

3 2 1 0 56. Students will be able to calculate range and initial acceleration from data they record from experiments.

3 2 1 0 57. Students will be able to analyze test data and utilize the results to make decisions.

3 2 1 0 58. Listen for and identify key words

3 2 1 0 59. Listen for words that identify a procedure

3 2 1 0 60. Listen for steps or actions to be performed

3 2 1 0 61. Listen for clues regarding the order or sequence in which a task is performed.

3 2 1 0 62. Students will be able to define and understand the importance of needs and wants, values, goals, and standards

3 2 1 0 63. Locate information and select the materials, tools, equipment, or other resources to perform the activities needed to accomplish a specific task

3 2 1 0 64. Develop strategies to overcome procrastination and meet deadlines.

3 2 1 0 65. Access and use information to develop educational and career options.

3 2 1 0 66. Value diversity, practice tolerance and acceptance, and work cooperatively toward common goals

3 2 1 0 67. Apply one or more problem-solving processes to a given situation(s)

3 2 1 0 68. Students will compose sketches using proper sketching techniques in the solution of design problems

3 2 1 0 69. Students will be able to design and create tables, charts, and graphs to illustrate data they have collected.

3 2 1 0 70. Students will mathematically explain the mechanical advantage gained and explain the function of the six different types of simple machines.

3 2 1 0 71. Students will design, diagram, and implement a program to control a device they construct to perform a sorting operation.

3 2 1 0 72. Students will mathematically analyze a simple truss to determine types and magnitude of forces supported in the truss.

3 2 1 0 73. Students will prepare and present a mathematical analysis of a truss design as part of a 5- minute oral presentation about their bridge design.

3 2 1 0 74. Students will be able to use a computer-aided engineering package to analyze a shape

3 2 1 0 75. Students will be able to mathematically estimate chance of failure of a system given information on certain components.

3 2 1 0 76. Students will be able to explain the difference between distance traveled and displacement.

3 2 1 0 77. Students will be able to explain how velocity and acceleration are calculated.

3 2 1 0 78. Students will be able to calculate range and initial acceleration from data they record from experiments

3 2 1 0 79. Students will identify and demonstrate the use of common dimensioning

3 2 1 0 80. Students will interpret data, which has been statically analyzed, to ensure product quality

3 2 1 0 81. Students will formulate a product cost analysis for given product.

21006 Engineering Design

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 provided by the organization.

3 2 1 0 8. 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.

3 2 1 0 10. Students will list the seven steps of the design process and explain the activities that occur during each phase.

3 2 1 0 11. Students will assess the value of working as a team and understand the benefits of collaboration.

3 2 1 0 12. Students will investigate the principles and elements of design and demonstrate their use in the design process.

3 2 1 0 13. Students will identify career opportunities in design engineering and explain their job functions.

3 2 1 0 14. Students will express their understanding of the principles and elements of design utilized in products, print media, and art forms.

3 2 1 0 15. Students will collect and display examples of the application of the principles and elements o design utilized in products, print media, and art forms.

3 2 1 0 16. Students will identify the proper elements of a fully developed portfolio.

3 2 1 0 17. Students will identify and discuss the ethical issues surrounding portfolio artifacts.

3 2 1 0 18. Students will compare and contrast defined elements of a good portfolio specified in the PowerPoint presentation to the sample provided in the PLTW Design Resource Guide.

3 2 1 0 19. Students will develop a portfolio to organize and display evidence of their work.

3 2 1 0 20. Students will integrate proper sketching techniques and styles in the creation of sketches.

3 2 1 0 21. Students will demonstrate the ability to produce two-dimensional geometric figures.

3 2 1 0 22. Students will select and produce the appropriate pictorial style to best communicate solutions in the design process.

3 2 1 0 23. Students will formulate pictorial sketches to develop ideas, solve problems, and understand relationships during the design process.

3 2 1 0 24. Students will create sketches utilizing both the additive and subtractive methods to assess underlying geometric and perceptual principles.

3 2 1 0 25. Students will select a sketching method that is efficient in its use of color, form, and symbols representing abstract data.

3 2 1 0 26. Students will augment pictorial sketches with shading to improve communication.

3 2 1 0 27. Students will evaluate and select the necessary views to graphically communicate design solutions.

3 2 1 0 28. Students will interpret annotated sketches in the design analysis process.

3 2 1 0 29. Students will integrate annotated sketches in presentations, portfolio, and documentation processes.

3 2 1 0 30. Students will develop properly annotated sketches to accurately convey data in design solution.

3 2 1 0 31. Students will define and contrast points, lines and line segments.

3 2 1 0 32. Students will identify major geometric shapes (isosceles triangle, right triangle, scalene triangle, rectangles, squares, rhombus, trapezoid, pentagon, hexagon, and octagon).

3 2 1 0 33. Using a compass, ruler and triangle, students will construct various geometric shapes.

3 2 1 0 34. Students will define terminology associated with arcs and circles.

3 2 1 0 35. Using a compass, ruler and triangle, students will construct arcs, circles and ellipses.

3 2 1 0 36. Students will distinguish and define geometric constraints.

3 2 1 0 37. Students will identify the following geometric constraints in given three dimensional models: horizontal, vertical, parallel, perpendicular, tangent, concentric, collinear, coincident, and equal.

3 2 1 0 38. Students will apply the right hand rule to identify the X, Y, and Z axes of the Cartesian Coordinate System.

3 2 1 0 39. Students will apply a combination of absolute, relative, and polar coordinates to construct a three-dimensional model.

3 2 1 0 40. Students will define the origin planes in the Coordinate System.

3 2 1 0 41. Students will experience the creative thinking process

3 2 1 0 42. Students will recognize the difference between vertical and lateral thinking.

3 2 1 0 43. Students will categorize and select a solution to a problem.

3 2 1 0 44. Students will communicate their idea through written and verbal formats.

3 2 1 0 45. Students will identify the different geographical methods of data representation.

3 2 1 0 46. Students will select the appropriate graphical format to a problem.

3 2 1 0 47. Students will analyze and develop graphical representation of given data.

3 2 1 0 48. Students will have an understanding of the different physical modeling techniques.

3 2 1 0 49. Students will present a model with its correct proportions.

3 2 1 0 50. Students will select the appropriate modeling materials to complete a three-dimensional model.

3 2 1 0 51. Students will evaluate a problem using mathematical formulas

3 2 1 0 52. Students will analyze a solution to a problem using the correct format of analysis.

3 2 1 0 53. Students will interpret a sketch using a CAD package.

3 2 1 0 54. Students will explain the difference between parametric and adaptive designs and be able to specify their uses.

3 2 1 0 55. Students will draw a two-dimensional sketch using CAD package.

3 2 1 0 56. Students will apply geometrical and dimensional constraints to a sketch.

3 2 1 0 57. Students will demonstrate the ability to generate a three-dimensional model.

3 2 1 0 58. Students will understand and demonstrate the use of work features and how they are applied while constructing a solid model.

3 2 1 0 59. Students will recognize the use and need of work planes, axes, and points in the development of a computer model.

3 2 1 0 60. Students will demonstrate the ability to modify a sketched feature of a model.

3 2 1 0 61. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 62. Students will understand and apply the base component effectively in the assembly modeling environment.

3 2 1 0 63. Students will place and create components effectively in the assembly modeling environment.

3 2 1 0 64. Students will create circular and rectangular patterns of components within an assembly model.

3 2 1 0 65. Students will replace components with modified external parts.

3 2 1 0 66. Students will perform part manipulation during the creation of an assembly model.

3 2 1 0 67. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 68. Students will perform part manipulation during the creation of an assembly model.

3 2 1 0 69. Students will apply assembly constraints to successfully construct a multi-part object.

3 2 1 0 70. Students will utilize part libraries effectively during the assembly modeling process.

3 2 1 0 71. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 72. Students will employ sub-assemblies during the production of assemblies.

3 2 1 0 73. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 74. Students will understand and apply drive constraints to simulate the motion of parts in assemblies.

3 2 1 0 75. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 76. Students will explore, understand, and apply adaptive design concepts during development of sketches, features, parts and assemblies.

3 2 1 0 77. Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.

3 2 1 0 78. Students will demonstrate how to extract mass properties data from their solid models.

3 2 1 0 79. Students will evaluate the accuracy of mass properties calculations.

3 2 1 0 80. Students will describe how analysis data can be used to update parametric models.

3 2 1 0 81. Students will generate an isometric view from orthographic drawing views.

3 2 1 0 82. Students will determine the correct application for the various section views.

3 2 1 0 83. Students will describe the purpose and application of hatch marks and a cutting plane line, as used in a section view.

3 2 1 0 84. Students will create the appropriate section view for a specified view.

3 2 1 0 85. Students will create a detail view that corresponds to the appropriate orthographic drawing view.

3 2 1 0 86. Students will create an auxiliary view to show the detail on an inclined surface of a drawing object.

3 2 1 0 87. Students will list the common dimensioning standards.

3 2 1 0 88. Students will identify and demonstrate the use of common dimensioning systems.

3 2 1 0 89. Students will describe the characteristics and demonstrate the use of unidirectional and aligned dimensioning.

3 2 1 0 90. Students will differentiate the use of and demonstrate an understanding of size and location dimensions by applying these types of dimensions to annotated sketches and drawings

3 2 1 0 91. Students will demonstrate appropriate dimensioning rules and practices.

3 2 1 0 92. Students will set up and integrate the use of a customized common dimensioning standard.

3 2 1 0 100. Students will identify and demonstrate the use of dimensioning practices on section, auxiliary, and assembly models.

3 2 1 0 101. Students will define and demonstrate an understanding of tolerancing, and solve tolerance problems.

3 2 1 0 102. Students will apply appropriate annotations on sketches and drawings.

3 2 1 0 103. Students will understand and formulate general and proprietary specifications to further communicate information relating to product design.

3 2 1 0 104. Students will demonstrate the following communications techniques: voice variation, eye contact, posture, attire, practice and preparation, and projecting confidence.

3 2 1 0 105. Students will have an understanding of various forms of visual aids and when to use them in a presentation.

3 2 1 0 106. Considering the audience and level of formality, students will select the most appropriate type of visual aid for a presentation.

3 2 1 0 107. Students will identify the need to evaluate the areas of manpower and facility requirements.

3 2 1 0 108. Considering the audience and level of formality, students will select the most appropriate type of written documentation for a presentation.

3 2 1 0 109. Students will identify the elements of the various forms of written documentation.

3 2 1 0 110. Students will recognize the need to involve all of the manufacturing team members in the decision making process of designing a product.

3 2 1 0 111. Students will be able to categorize manufacturing specifications and constraints needed to produce a product.

3 2 1 0 112. Students will be able to evaluate material characteristics for manufacturing a specific product and identify the correct manufacturing process needed to produce that product.

3 2 1 0 113. Students will evaluate and apply the correct machine process.

3 2 1 0 114. Students will recognize the need to limit the number of processes used to manufacture a product.

3 2 1 0 115. Students will develop an understanding of process routing.

3 2 1 0 116. Students will distinguish the differences between CNC, FMS, and CIM.

3 2 1 0 117. Students will explain the need for a company to minimize material handling by procurement of materials in a timely fashion. Students should explain the JIT process.

3 2 1 0 118. Students will identify the need to perform a cost analysis of a product.

3 2 1 0 119. Students will interpret data, which has been statistically analyzed, to ensure product quality.

3 2 1 0 120. Students will recognize the need to protect a product for shipping.

3 2 1 0 121. Students will analyze aesthetic requirements to enhance packaging for the consumer.

3 2 1 0 122. Students will define, explain, and demonstrate an understanding of common vocabulary words used in association with product cost analysis.

3 2 1 0 123. Students will formulate a product cost analysis for a given product.

3 2 1 0 124. Students will demonstrate an understanding of packaging design requirements.

3 2 1 0 125. Students will design a package for given product.

3 2 1 0 126. Listen for and identify key words.

3 2 1 0 127. Listen for words that identify a procedure.

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

21009 Robotics

3 2 1 0 1. Build or assemble robotic devices or systems.
3 2 1 0 2. Align, fit, or assemble component parts using hand tools, power tools, fixtures, templates, or microscopes.
3 2 1 0 3. Troubleshoot robotic systems using knowledge of microprocessors, programmable controllers, electronics, circuit analysis, mechanics, sensor or feedback systems, hydraulics and pneumatics.
3 2 1 0 4. Train robots using artificial intelligence software to perform simple or complex tasks such as designing and carrying out a series of tests.
3 2 1 0 5. Disassemble and reassemble robots or peripheral equipment to make repairs such as replacement of defective circuit boards, sensors, controllers, encoders, and servomotors.
3 2 1 0 6. Perform corrective maintenance on robotic systems or components.
3 2 1 0 7. Install, program, and repair programmable controllers, robot controllers, end-of-arm tools, or conveyors.
3 2 1 0 8. Read blueprints, schematics, diagrams, or technical orders to determine methods and sequences of assembly.
3 2 1 0 9. Analyze and record test results, and prepare written testing and documentation.

3 2 1 0 10. Explain complex mathematical information used in robotic operations.
3 2 1 0 11. Verify dimensions and clearances of parts to ensure conformance to specifications, using precision measuring instruments.
3 2 1 0 12. Debug robotics programs.
3 2 1 0 13. Read and utilize blueprints in the technical process.
3 2 1 0 14. Read and utilize production layouts.
3 2 1 0 15. Read and utilize technical drawings as necessary in robotic assembly and usage.
3 2 1 0 16. Troubleshoot mechanical failures or unexpected problems.
3 2 1 0 17. Integrate robotics with peripherals or other equipment.
3 2 1 0 18. Demonstrate knowledge of how automated robotic systems increase production volume and precision in a variety of high-throughput operations.
3 2 1 0 19. Resolve engineering or science problems using robots.
3 2 1 0 20. Analyze test results in relation to design or rated specifications and test objectives, and modify or adjust equipment to meet specifications.
3 2 1 0 21. Record test procedures and results, numerical and graphical data, and recommendations for changes in product

39108 Advanced Production Blueprint Reading

4 3 2 1 0 1. Identify and interpret symbols specific to manufacturing production and a variety of technical fields, such as mechanical, electrical, plumbing and pipefitting, power distribution, process and instrumentation, architectural, and process flow diagrams.
4 3 2 1 0 2. Interpret work from multiview drawings and computer models used in manufacturing applications to include engineering, architectural, and schematic representations.
4 3 2 1 0 3. Determine processes and procedures for diagnostic applications or job completion.
4 3 2 1 0 4. Demonstrate proficiency reading technical information including dimensioning techniques.
4 3 2 1 0 5. Visualize shapes and objects in multiple views to interpret various drawings used in manufacturing, commercial, and industrial manufacturing which may include electrical, schematics, plumbing, piping ISO's, piping and instrumentation diagrams, architectural and civil.
4 3 2 1 0 6. Develop a work order from production blueprint to create a product from a multiview drawing.

21005 Engineering Comprehensive

Architectural and Structural Engineering

3 2 1 0 1. Understand the theoretical, practical, and contextual issues that influence design:
a. Understand the ways in which sociocultural conditions and issues influence architectural design.
b. Use the necessary equipment for producing an architectural design and the appropriate methods and techniques for employing the equipment.
c. Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.
3 2 1 0 2. Students understand the use of computer-aided drafting and design (CADD) in developing architectural design
3 2 1 0 3. Use CADD software to develop a preliminary architectural design.
3 2 1 0 4. Students will create written and digital portfolios.

Computer Hardware, Electrical, and Networking Engineering

3 2 1 0 5. Understand the characteristics of alternating current (AC) and how AC is generated; the characteristics of the sine wave; the basic characteristics of AC circuits, tuned circuits, and resonant circuits; and the nature of the frequency spectrum.
3 2 1 0 6. Calculate, construct, measure, and interpret both AC and DC circuits.
3 2 1 0 7. Use appropriate electronic instruments to analyze, repair, or

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 peripherals.

3 2 1 0 10. Understand the relationship among computer hardware, networks, and operating systems.

3 2 1 0 11. Understand the steps in the design process.

3 2 1 0 12. 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.

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 engineering design equipment.

3 2 1 0 20. Apply conventional engineering design processes and procedures accurately, appropriately, and safely.

3 2 1 0 21. Apply the concepts of engineering design to the tools, equipment, projects, and procedures of the Engineering Design Pathway.

3 2 1 0 22. Understand scalars and vectors and solve problems by using the concept of vectoring to predict the resultant forces.

3 2 1 0 23. Know the six simple machines and their applications.

3 2 1 0 24. Know the common structure and processes of a quality assurance cycle.

3 2 1 0 25. Calibrate and measure objects by using precision measurement tools and instruments.

Environmental and Natural Science Engineering

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 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 events.

21201-Foundations of Electronics

Lab Practices

3 2 1 0 1. Apply proper OSHA safety standards.

3 2 1 0 2. Make electrical connections.

3 2 1 0 3. Identify and use hand tools properly

3 2 1 0 4. Demonstrate acceptable soldering and desoldering techniques.

3 2 1 0 5. Demonstrate knowledge of surface mount technology.

Demonstrate Proficiency in DC Circuits

3 2 1 0 6. Solve algebraic problems to include exponentials (prerequisite to DC).

3 2 1 0 7. Relate electricity to the nature of matter.

3 2 1 0 8. Identify sources of electricity.

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 circuits.
3 2 1 0 20. Construct and verify the operation of series-parallel circuits.
3 2 1 0 21. Troubleshoot series-parallel circuits.
3 2 1 0 22. Identify and define voltage divider 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 theory.
3 2 1 0 27. 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 differentiators and integrators.
3 2 1 0 31. 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 meter, and generator.
3 2 1 0 40. Define the characteristics of AC capacitive circuits.
3 2 1 0 41. Construct and verify the operation of AC capacitive circuits.
3 2 1 0 42. Troubleshoot AC capacitive circuits.
3 2 1 0 43. Define the characteristics of AC inductive circuits.
3 2 1 0 44. 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 transformers.
3 2 1 0 48. 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 circuits.
3 2 1 0 51. 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:
a. Define a problem
b. Brainstorm
c. Research and generate Ideas
d. Recognition of identifying criteria and constraints and possible solutions
e. Design Proposal
f. Modeling and Prototyping
g. Testing and Evaluating
h. Refining
i. Production
j. 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:

a. anticipated employment,
b. drivers and constraints,
c. size and location of market,
d. connection(s) to existing technologies,
e. ability and ease of replication,
f. physical and capital costs,
g. industry and education partnerships to be leveraged,
h. national best practices,
i. illustrate qualifications, and recommendations, aims and approaches for the Technological innovation
j. Innovation system modeling
k. Technology monitoring, forecasting and assessment
l. Trend analysis methods & scenarios
m. Impact assessment
n. Risk analysis
o. Action (policy) analysis
p. Technology road mapping
q. Communication and implementation of innovation forecasts

APPLICATION LEVEL COURSES

21053 Emerging Technologies

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

3 2 1 0 1. Demonstrate the research skills necessary to identify and evaluate emerging technologies

3 2 1 0 2. Seek and identify sources of information on new technology.

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

3 2 1 0 4. Identify sciences and technology areas most impacted and with most potential to utilize the new technologies.

3 2 1 0 5. Be able to explain why it is important for STEM professionals to keep abreast of evolving technologies.

3 2 1 0 6. Be able to discuss the advantages, disadvantages, and prospects of current emerging technologies.

3 2 1 0 7. Discuss in depth a chosen emerging technology, based on independent research.

3 2 1 0 8. Explain the change process.

3 2 1 0 9. Develop a plan for anticipating change.

3 2 1 0 10. Address each of the following areas to varying degrees based on available information:

a. anticipated employment,
b. drivers and constraints,
c. size and location of market,
d. connection(s) to existing technologies,
e. ability and ease of replication,
f. physical and capital costs,
g. industry and education partnerships to be leveraged,
h. national best practices,
i. illustrate qualifications, and recommendations, aims and approaches for the Technological innovation
j. Innovation system modeling
k. Technology monitoring, forecasting and assessment
l. Trend analysis methods & scenarios
m. Impact assessment
n. Risk analysis
o. Action (policy) analysis
p. Technology road mapping
q. Communication and implementation of innovation forecasts

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 2. Students will understand the causes of and the dangers from electric shock and explain methods to prevent it.

3 2 1 0 3. Students will understand that the process of designing an electronic circuit takes into account many factors, including environmental concerns, and will be familiar with precautionary measures.

3 2 1 0 4. Students will be able to define and explain the difference between direct and alternating currents.

3 2 1 0 5. Students will be able to convert number values from binary, hexadecimal, and decimal formats.

3 2 1 0 6. Students will understand the material makeup of resistors and how they are used in circuit design.

3 2 1 0 7. Students will understand the blueprint/schematic symbols corresponding to various parts used in electronics and circuitry.

3 2 1 0 8. Students will be able to correctly setup lab equipment to safely design, test, and utilize electronics designs.

3 2 1 0 9. Students will calculate the tolerance levels of various electronics parts to determine if the measured value is within specifications for quality assurance/reliability.

3 2 1 0 10. Students will be able to draw and label the parts of a simple circuit.

3 2 1 0 11. Students will build and test a variety of series and parallel circuits, using simulation software and proto-boards, to prove the accuracy of Ohm's and Kirchhoff's laws.

3 2 1 0 12. Students will correctly select and utilize electrical meters to determine voltage, resistance, and current in simple circuits.

3 2 1 0 13. Students will calculate the resistance, current and voltage in a circuit using Ohm's law.

3 2 1 0 14. Students will describe the component parts of a capacitor and describe how a capacitor holds a static charge.

3 2 1 0 15. Students will use and understand the units of measurement for various electronic parts and be able to calculate their characteristics mathematically and through instrumentation.

3 2 1 0 16. Students will be familiar with different types of capacitors and their voltage polarity requirements.

3 2 1 0 17. Students will be able to draw a digital waveform and identify the anatomy of the waveform.

3 2 1 0 18. Students will differentiate between digital and analog signals when given the waveforms.

3 2 1 0 19. Students will wire and test a free-running clock circuit using a 555 timer.

3 2 1 0 20. Students will calculate the output frequency of a clock circuit using observations and the oscilloscope.

3 2 1 0 21. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems.

3 2 1 0 22. Students will identify the name, symbol, and function and create the truth table, and Boolean Expression for the basic logic gates through research and experimentation.

3 2 1 0 23. Students will recognize the relationship between the Boolean expression, logic diagram, and truth table.

3 2 1 0 24. Students will be able to create Boolean Expressions, logic circuit diagrams or truth tables from information provided in the solution of design problems.

3 2 1 0 25. Students will apply the rules of Boolean algebra to logic diagrams and truth tables to minimize the circuit size necessary to solve a design problem.

3 2 1 0 26. Students will use DE Morgan’s Theorem to simplify a negated expression and to convert an SOP to a POS and vice versa, in order to save resources in the production of circuits.

3 2 1 0 27. Students will formulate and employ a Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest forms.

3 2 1 0 28. The students will create circuits to solve a problem using NAND or NOR gates to replicate all logic functions.

3 2 1 0 29. The students will apply their understanding of the workings of NOR and NAND gates to make comparisons with standard combinational logic solutions to determine amount of resource reduction.

3 2 1 0 30. Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.

3 2 1 0 31. Students will discover the code to create numbers on a seven segment display by experimentation.

3 2 1 0 32. Students will design a circuit to control a seven segment display with a decimal to BCD encoder and a display driver.

3 2 1 0 33. Students will control the flow of data by utilizing multiplexers and demultiplexers.

3 2 1 0 34. Students will be able to design and implement combinational logic circuits using reprogrammable logic devices.

3 2 1 0 35. Students will create PLD logic files that define combinational circuit designs using Boolean Expressions.

3 2 1 0 36. Students will understand and use logic compiler software to create JEDEC files for programming PLDs.

3 2 1 0 37. Students will demonstrate understanding of binary addition and subtraction by designing circuits to produce correct answers.

3 2 1 0 38. Students will create and prove the truth table for both half and full adders.

3 2 1 0 39. Students will design, construct and test adder circuits using both discrete gates and MSI gates.

3 2 1 0 40. Students will conduct and test simple latches and flip-flops from discrete gates.

3 2 1 0 41. Students will interpret, design, draw, and evaluate circuits using the logic symbols for latches and flip-flops.

3 2 1 0 42. Students will be able to interpret waveform diagrams form circuits they construct and compare them with combinational waveforms.

3 2 1 0 23. Students will compare and contrast operation of synchronous with asynchronous flip-flops circuits they construct.

3 2 1 0 44. Students will be able to create and interpret timing diagrams and truth tables for J-K Flip- Flops.

3 2 1 0 45. Students will understand different types of triggers used by latches and flip-flops, and select the appropriate one for the circuits they design.

3 2 1 0 46. Students will analyze timing diagrams that reflect triggering to identify distinguishing characteristics.

3 2 1 0 47. Students will conduct experiments with clock pulse width to determine the effect on the accuracy of data transmission.

3 2 1 0 48. Students will assemble circuits and compile information about the various applications of flip- flops.

3 2 1 0 49. Students will conduct experiments to determine the basic principles of how shift registers work.

3 2 1 0 50. Students will evaluate the use of shift registers in product design and the speeds at which those products run.

3 2 1 0 51. Students will create a circuit using discrete flip-flops to discover the operation and characteristics of asynchronous counters.

3 2 1 0 52. Students will design, simulate, build and test Mod counters using discrete gates in the solution to a design problem.

3 2 1 0 53. Students will design, simulate, build and test asynchronous Mod counters using an integrated counter chip (MSI).

3 2 1 0 54. Students will design, simulate, build and test synchronous Mod counters using discrete gates to solve a problem.

3 2 1 0 55. Students will be able to formulate a flow chart to correctly apply basic programming concepts in the planning of a project.

3 2 1 0 56. Students will appropriately select, size, and implement interface devices to control external devices.

3 2 1 0 57. Students will design and create programming to control the position of stepper motors.

21048 Workplace Experience

3 2 1 0 1. Employ effective listening skills when working with client.

3 2 1 0 2. Employ customer service principles when working with consumers.

3 2 1 0 3. Evaluate and follow-up on customer service provided.

3 2 1 0 4. Employ safety skills and equipment usage in appropriate ways.

3 2 1 0 5. Be aware of MSDS (Material Safety Data Sheets) and other safety resources and employ those resources as required for the workplace.

21252 Materials Science and Engineering

3 2 1 0 1. Identify key participants and events in the science and history of materials science and engineering, including areas of metallurgy,

polymers, ceramics, and composite development.

3 2 1 0 2. Identify professional organizations and resources available to provide additional information on materials science.

3 2 1 0 3. Recognize and know how to utilize the MSDS information in the workplace and where to find it.

3 2 1 0 4. Recognize physical properties of materials: solid, liquid, gas, and plasma.

3 2 1 0 5. (#4 Primary Alternate) Recognize materials properties(such as but not limited to):

- Mechanical properties
  - Compressive strength
  - Ductility
  - Hardness
  - Specific Weight
  - Tensile Strength
  - Density
- Electrical properties
  - Electrical conductivity
  - Dielectric/Piezoelectric properties
- Thermal properties
  - Thermal conductivity
  - Thermal expansion
  - Heat of vaporization
  - Flammability/FlashPoint/Autoignition Temperature
  - Vapor Pressure
  - Melting Point
  - Boiling Point
  - Curie point (loss of magnetism by heat)
- Chemical properties
  - pH
  - Reactivity
  - Solubility (ionic vs. covalent)
  - Corrosion resistance
- Magnetic properties
  - Permeability
- Optical properties
  - Absorptivity
  - Reflectivity
  - Refractive index
  - Color
  - Transmittance
  - Scattering
- Acoustical properties
  - Acoustical absorption
  - Speed of sound
- Environmental properties
  - Embodied energy (sustainability … used in LEED)
  - RoHS compliance (Hazardous Materials)
- Atomic properties
  - Atomic number - applies to pure elements only
  - Atomic mass - applies to individual isotopes or specific mixtures of isotopes of a given element (useful in discussion of alloys & composites).
- Manufacturing properties
  - Machining speeds and feeds
  - Machinability rating
  - Hardness
  - Extruding temperature and pressure
  - Castability

3 2 1 0 6. (#4 Secondary Alternate) Recognize key properties of materials: reactivity, toxicity, flammability, stability

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.

3 2 1 0 10. Identify reasons for particular materials to be chosen over other materials for specific applications.

3 2 1 0 11. Identify various methods for physical bonding of materials.

3 2 1 0 12. Explain appropriate usage/advantage of physical bonds over chemical bonds in various applications.

3 2 1 0 13. Identify various methods for chemical bonding of materials.

3 2 1 0 14. Explain appropriate usage/advantage of chemical bonds over physical bonds in various applications.

3 2 1 0 15. Define tribology and its importance.

3 2 1 0 16. Describe the impact of biomaterials on the industry.

3 2 1 0 17. Identify and describe a material that has recently become available or has recently been adopted for widespread use and how it may impact future design and development.

3 2 1 0 18. Describe manufacturing processes that have changed due to availability of new materials.

3 2 1 0 19. 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

that are not available in other courses and should be enumerated in addition to those listed below.

Possible topics (you will have others):

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

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

3 2 1 0 1. Define scope of work (or area to be researched) and appropriately document the process.

3 2 1 0 2. Summarize the process of engineering a new design or utilization of material to be examined.

a. Plan for products/services using reliability factors.

b. Demonstrate knowledge of the key functions and subsystems of the product.

c. Demonstrate knowledge of cross-functional team structures and team members' roles.

d. Create/evaluate products/services using reliability factors.

e. Identify testing methodologies, and system analysis requirements.

3 2 1 0 3. Assess the importance of new technology to future developments.

3 2 1 0 4. Identify trends and major current issues associated with topic.

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

21007 Engineering Design & Development

3 2 1 0 1. Calculate the required equipment and materials for mechanical construction applications.

3 2 1 0 2. Apply conventional construction measurement processes accurately (geometric and trigonometric functions).

3 2 1 0 3. Know significant historical architectural and structural projects and their effects on society.

3 2 1 0 4. Understand the development of 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 7. Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.

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

3 2 1 0 13. Use sketching techniques as they apply to a variety of architectural and engineering models.

3 2 1 0 14. Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.

3 2 1 0 15. 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.

3 2 1 0 19. Know how the various measurement systems are used in engineering drawings.
3 2 1 0 20. Understand the degree of accuracy necessary for engineering design.
3 2 1 0 21. Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means.
3 2 1 0 22. Understand the orthographic projection process for developing multi-view drawings.
3 2 1 0 23. Understand the various techniques for viewing objects.
3 2 1 0 24. Use the concepts of geometric construction in the development of design drawings.
3 2 1 0 25. Apply pictorial drawings derived from orthographic multi-view drawings and sketches and from a solid modeler.
3 2 1 0 26. Understand the commands and concepts necessary for editing engineering drawings.
3 2 1 0 27. Know the various object-altering techniques.
3 2 1 0 28. Know the CADD components and the operational functions of CADD systems.
3 2 1 0 29. Apply two-dimensional and three-dimensional CADD operations in creating working and pictorial drawings, notes, and notations.
3 2 1 0 30. Understand how to determine properties of drawing objects.
3 2 1 0 31. Know a variety of drafting applications and understand the proper dimensioning styles for each.
3 2 1 0 32. Apply dimensioning to various objects and features.
3 2 1 0 33. Edit a dimension by using various editing methods.
3 2 1 0 34. Understand the function of sectional views.
3 2 1 0 35. Use a sectional view and appropriate cutting planes to clarify hidden features of an object.
3 2 1 0 36. Understand what constitutes mating parts in engineering design.
3 2 1 0 37. Use tolerancing in an engineering drawing.
3 2 1 0 38. Interpret geometric tolerancing symbols in a drawing.
3 2 1 0 39. Understand the processes of lettering and text editing.
3 2 1 0 40. Develop drawings using notes and specifications.
3 2 1 0 41. Understand the methods of title block creation.
3 2 1 0 42. Apply conventional engineering technology processes and procedures accurately, appropriately, and safely.
3 2 1 0 43. Choose between alternate solutions in solving a problem and be able to justify the choices made in determining a solution.
3 2 1 0 44. Build a prototype from plans and test it.
3 2 1 0 45. Calibrate and measure objects by using precision measurement tools and instruments.

21205 Project Management and Resource Scheduling

3 2 1 0 1. Recognize different resource types (Work, Material, Cost, Budget, Personnel/Skills, Generic, etc)
3 2 1 0 2. Understand the concept of scope and demonstrate in context of assessing the size of a project.
3 2 1 0 3. Develop plans for project management and resource scheduling.
3 2 1 0 4. Identify key personnel and responsibilities for project.
3 2 1 0 5. Develop SWOT analysis [Strengths, Weaknesses, Opportunities, and Threats] for project.
3 2 1 0 6. Analyze workload of tasks and projects.
3 2 1 0 7. Determine required personnel groups and management hierarchy.
3 2 1 0 8. Determine resources necessary for project completion.
3 2 1 0 9. Determine essential tasks necessary for project completion.
3 2 1 0 10. Design potential timelines for assignments.
3 2 1 0 11. Explore appropriate technologies for project management and resource scheduling.
3 2 1 0 12. Create and present a project management and resource scheduling plan.
3 2 1 0 13. Create Gantt charts.
3 2 1 0 14. Evaluate and assign resources to tasks.
3 2 1 0 15. Implement project management skills to design and complete a collaborative project.
3 2 1 0 16. Learn various survey strategies to track project progress.
3 2 1 0 17. Develop strategies for monitoring interconnected assignments.
3 2 1 0 18. Survey strategies for critical path scheduling.
3 2 1 0 19. Create strategies to manage project budgets.

3 2 1 0 20. Build survey analysis for customer satisfaction

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.
3 2 1 0 17. Identify a control system and explain its application to 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 1. Summarize the components of effective communication.
3 2 1 0 2. List the forms of documentation needed for effective communication.
3 2 1 0 3. Outline the steps necessary to keep one's self safe in a laboratory setting.
3 2 1 0 4. Relates what could happen to experiment results if measurement is performed or recorded incorrectly.
3 2 1 0 5. Distinguishes the difference between accuracy and precision
3 2 1 0 6. Explains how both accuracy and precision play a vital role in the design process

Biotechnical Engineering History and Industry

3 2 1 0 7. Outline the evolution of biotechnical engineering.
3 2 1 0 8. Illustrate the major biotechnical engineering milestones using a wide variety of internet resources.
3 2 1 0 9. Assess the impact of each milestone based on their research.
3 2 1 0 10. Identify the fundamental concepts common to all major industries in biotechnical engineering.
3 2 1 0 11. Identify and explain how biotechnical engineered products impact society.
3 2 1 0 12. Predict future developments in biotechnical engineering.
3 2 1 0 13. Investigate the relationship between financial markets and scientific research

Values and Ethics

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

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

3 2 1 0 16. Discuss bioethics.

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

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

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

Bioinformatics

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

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

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

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

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

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

Fermentation

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

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

3 2 1 0 28. Explain what variables affect 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

solution for an engineering or architecture project.

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

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

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

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

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

3 2 1 0 13. Students will apply their knowledge of architectural styles to the design of the structures. 3 2 1 0 14. Students will apply their knowledge of floor plans to the structures.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

using various drawing methods, develop two and three dimensional sketches, graphics, or other media (including computer assisted media) collected and documented.

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

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

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

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

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

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

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

3 2 1 0 14. Students will compare and contrast the various elevations views and communicate their understanding of how elevations are used in the design of the project's structures.

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

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

21013 Aerospace Engineering

History of Flight

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

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

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

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

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

Aerodynamics

3 2 1 0 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.

3 2 1 0 4. Students will demonstrate basic knowledge of aerodynamics and physics.

3 2 1 0 5. Students will utilize the design process, with computer simulation

3 2 1 0 6. 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 to represent a full-size system.

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

3 2 1 0 4. Students will select appropriate hand tools and equipment, and operate tools and equipment selected to create accurate scale models.

Wind Tunnel Testing

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

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

3 2 1 0 3. Students will use the wind tunnel to 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.

3 2 1 0 5. Students will construct multiple designs capable of achieving similar results.

Measuring Rocket Engine Thrust

3 2 1 0 1. Rocket thrust is measured using a simple device.
3 2 1 0 2. Students calibrate thrust measurements
3 2 1 0 3. Thrust vs. time data is acquired using a data taking device.

Model Rocket Trajectory

3 2 1 0 1. Parts of a model rocket and parts of a model rocket engine are identified by the student.
3 2 1 0 2. Students understand and explain how the forces of weight, thrust, drag, and lift interact differently on a rocket in flight.
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 each phase of a rocket launch.
3 2 1 0 4. Rockets are designed with features that are interrelated.
3 2 1 0 5. The student will calculate the maximum velocity and maximum acceleration of a rocket during flight.
3 2 1 0 6. The student will calculate a rocket's maximum altitude by using indirect 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 design and project to answer a research question.
3 2 1 0 4. Students formulate a research question based on research, gathering data, analyzing data, and making judgments about experimental data.
3 2 1 0 5. Students use the scale factor of aerial photographs to determine a rocket's altitude, number, and kind of objects in the photograph, and the dimension of objects in the photographs.
3 2 1 0 6. Students use aerial photographs to identify, classify, and enumerate objects in the photograph.
3 2 1 0 7. Students understand that a rocket's launch angle affects the forces of lift, thrust, weight, and drag.

Orbital Mechanics

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 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 3. Students calculate to show that an object in orbit is continuously "falling" toward the body about around which they orbit.
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 prediction of the precise location of the satellite at a given time.

Life Support & Environmental Systems

3 2 1 0 1. Students describe basic physiological needs of the human body when living safely within and outside of Earth's atmosphere.
3 2 1 0 2. The students make a model to show how the environment on earth and in space must be considered when designing solutions to problem in aerospace engineering
3 2 1 0 3. Students discuss how engineers have solved many technological challenges faced when designing solutions for living higher atmospheres and space.
3 2 1 0 4. Students develop a demonstration of force, mass, and acceleration phenomena or G-forces that astronauts, fighter pilots, and Formula One drivers might experience.

Effect of Gravity on the Human Body

3 2 1 0 1. Students simulate a 1-g, Earth-normal, environment
3 2 1 0 2. Students simulate the action of spinning and how it can fool the senses and stimulate the vestibular system in the inner ear.
3 2 1 0 3. Students work in cooperative and supportive teams to simulate how theses behaviors result in increased safety and higher quality data.
3 2 1 0 4. Students investigate and give examples of how a stress-filled environment is physically unique and can affect the ability to perform mental functions.
3 2 1 0 5. Students identify common equipment that can be used for data acquisition.
3 2 1 0 6. Students use spreadsheet software to collect, analyze and report data.

Microgravity Drop Tower

3 2 1 0 1. Students describe gravity and its effects on other masses.
3 2 1 0 2. Students state the value of "g" on earth.
3 2 1 0 3. Students demonstrate microgravity
3 2 1 0 4. Students describe the microgravity environment associated with the space shuttle

3 2 1 0 5. Students list the types of experiments that can be done in microgravity.

Composites Fabrication & Testing

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

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

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

3 2 1 0 4. Students determine how the strength and stiffness of composite materials can be significantly increased.

3 2 1 0 5. The student will assess material performances by comparing strength to weight ratios.

3 2 1 0 6. Students will test composite materials using a deflection test to evaluate the stiffness of various composite plastic samples.

Thermal Protection Systems for Vehicles

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

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

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

3 2 1 0 4. Thermal Protection Systems (TPS) are described by the students.

Intelligent Vehicles

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

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

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

3 2 1 0 4. Students will define the meaning of pH values.

3 2 1 0 5. Students will describe uses for robotic devices.

3 2 1 0 6. Students will list robotic devices that are composed of mechanical, electrical, and computer based systems that can be programmed to make decisions and control actions based upon sensor readings.

3 2 1 0 7. Students will construct a robot device that performs a task.