

INFORMATION TECHNOLOGY CAREER CLUSTER DESIGN

Approved Pathway:

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

Computer Science Engineering Pathway – CIP Code 11.0701

INTRODUCTORY LEVEL

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

TECHNICAL LEVEL

● Technical Introduction to Computer Science (ICS)	41010	1 credit		● Computer Science Applications (CSA)	41020	1 credit
● Computer Science and Software Engineering (CSE)	41011	1 credit				

APPLICATION LEVEL

● Simulation and Modelling (SAM)	41030	1 credit		● Cybersecurity (SEC)	41036	1 credit
Particular Topics in Engineering	21015	1 credit		● Artificial Intelligence (AI)	41034	1 credit
● Computational Problem Solving (CPS)	41037	1 credit		Workplace Experience	21048	1 credit
Project Management and Resource Scheduling	21205	1 credit				

- Course appropriate for Project Lead the Way Programs; competencies may be utilized by any/all schools.
- Φ Course appropriate for Engineering by Design Programs; competencies may be utilized by any/all schools
- ✓ Course is eligible for Regents Qualified Admissions – Natural Science

KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE
 COMPUTER SCIENCE ENGINEERING PATHWAY (C.I.P. 11.0701)

STEM CLUSTER

STUDENT _____
 Rating Scale:

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

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

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 valence electrons and its position on the periodic table.
- 3 2 1 0 41. Explain how the Law of Charges holds an atom together.
- 3 2 1 0 42. Explain how electrons transfer from one atom to another to create electron flow.
- 3 2 1 0 43. Define current, voltage, and resistance.
- 3 2 1 0 44. Measure voltage and current using a multimeter.
- 3 2 1 0 45. Understand the properties of a magnet.
- 3 2 1 0 46. Build an electromagnet to demonstrate its characteristics and functions.
- 3 2 1 0 47. Build a DC motor to identify the primary parts and demonstrate how it functions.
- 3 2 1 0 48. Build a generator to identify the primary parts and demonstrate how it functions.
- 3 2 1 0 49. Understand the role of an electromagnet in the function of a DC motor and generator.
- 3 2 1 0 50. Compare the characteristics of a basic motor and generator.
- 3 2 1 0 51. Build series, parallel, and combination electrical circuits.
- 3 2 1 0 52. Create circuit diagrams using standardized schematic symbols.
- 3 2 1 0 53. Build and test physical electrical circuits based upon circuit diagrams.
- 3 2 1 0 54. Integrate DC sources, lamps, switches, diodes, light emitting diodes, resistors, and capacitors into electrical circuits to achieve specific functions.
- 3 2 1 0 55. Distinguish between the functions and operations of fixed resistors, variable resistors, and photo resistors.
- 3 2 1 0 56. Determine the value of a fixed resistor based upon the color codes on those resistors.
- 3 2 1 0 57. Measure voltage, current, and resistance using a multimeter.
- 3 2 1 0 58. Mathematically calculate voltage, current, and resistance using Ohm's law.
- 3 2 1 0 59. Create a circuit that uses a transistor as a switch.
- 3 2 1 0 60. Interpret logic scenarios to determine outputs based upon possible conditions within those scenarios.
- 3 2 1 0 61. Distinguish between the functions of NOT, AND, OR, NAND, NOR, and XOR gates.
- 3 2 1 0 62. Create truth tables for logic scenarios and match those gates to truth tables.
- 3 2 1 0 63. Convert binary numbers to Base-10.
- 3 2 1 0 64. Convert ASCII characters to binary.
- 3 2 1 0 65. Create a digital wave form and graph it for a binary sequence.
- 3 2 1 0 66. Communicate using electronic circuit diagrams.
- 3 2 1 0 67. Use transistors as switches to create circuits that function as AND and OR gates.
- 3 2 1 0 68. Determine the logic, sensors, gates, outputs, and other components needed to emulate existing electronic devices that utilize logic.
- 3 2 1 0 69. Design, construct, and test device solutions for emulating common electronic devices that utilize logic.

10004-Computer Applications

- 3 2 1 0 1. Personal Information Management
- word usage, spelling, sentence structure, clarity, email
 - Demonstrate knowledge of email etiquette.
 - Send email messages.
 - Access email attachments.
 - Attach documents to messages.
 - Demonstrate knowledge of contamination protection strategies for email.
 - Save email messages / attachments.
- 3 2 1 0 2. Research and Internet
- Locate information using search engine(s) and Boolean logic.
 - Navigate web sites using software functions.
 - Select appropriate search procedures and approaches.
 - Select search engine(s) to use.
 - Access business and technical information using the Internet.
 - Access commercial, government, and education resources.
 - Evaluate Internet resources (e.g., accuracy of information).
 - Explore browser features.
 - Test Internet connection.
 - Unpack files using compression software.
 - 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 Baldrige award.
- e. Demonstrate knowledge of quality management terminology.

10002 Computing Systems

- 3 2 1 0 1. Apply knowledge of operating systems principles to ensure optimal functioning of system.
 - a. Interact with/respond to system messages using console device.
 - b. Apply basic commands of operating system software.
 - c. Apply appropriate file and disk management techniques.
 - d. Employ desktop operating skills.
 - e. Follow power-up and log-on procedures.
 - f. Run applications . jobs in accordance with processing procedures.
 - g. Follow log-off and power-down procedure(s).
 - h. Handle materials and equipment in a responsible manner.
- 3 2 1 0 2. Clearly document procedures for future use.
 - a. Document step-by-step installation and configuration procedures.
- 3 2 1 0 3. Communicate and recognize goal achievement.
 - a. Communicate goal achievement.
 - b. Provide recognition for goal achievement.
- 3 2 1 0 4. Configure systems to provide optimal system interfaces.
 - a. Apply concepts of privileged instructions and protected mode programming.
 - b. Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network).
 - c. Allocate disk space, non-sharable

- resources, and I/O devices.
- d. Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures).
- e. Identify standards and issues related to I/O programming and design of I/O interfaces.
- f. Define hardware-software interface issues for a computer system.
- g. Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats).
- 3 2 1 0 5. Configure/modify system as needed.
- a. Build system software command structures using operating system macro facilities for computer systems.
- b. Identify scheduling priority in programming.
- c. Identify data requirements.
- d. Review automated scheduling software.
- e. Secure needed supplies and resources.
- 3 2 1 0 6. Determine audience and information needs
- a. Define research questions.
- b. Identify target audience.
- 3 2 1 0 7. Document procedures and actions.
- a. Develop audit trails.
- 3 2 1 0 8. Ensure that hardware and software system components are compatible prior to performing installation.
- a. processor, memory, disk space, communications, printers, monitors).
- b. Determine compatibility of hardware and Identify hardware requirements (e.g., software.
- 3 2 1 0 9. Ensure that software to be installed is licensed prior to performing installation.
- a. Verify conformance to licensing agreement.
- 3 2 1 0 10. Evaluate information systems problem-solving techniques and approaches.
- a. Evaluate systems engineering considerations.
- b. Identify potential problems in system implementation.
- c. Summarize application planning, development, and risk management for information system.
- d. Demonstrate knowledge of critical thinking skills and techniques.
- e. Demonstrate knowledge of decision-making skills and techniques.
- f. Develop a plan using data-oriented techniques.
- g. Determine whether prototyping system is feasible.
- h. Determine software design process, from specification to implementation.
- i. Appraise software process and product life-cycle models.
- j. Assess software design methods and tools.
- 3 2 1 0 11. Evaluate information.
- a. Determine the accuracy and completeness of the information gathered.
- 3 2 1 0 12. Explain data communications procedures, equipment and media.
- a. Demonstrate knowledge of the uses of data communications media.
- b. Demonstrate knowledge of the uses of data communications equipment.
- c. Demonstrate knowledge of key communications procedures.
- 3 2 1 0 13. Explain measurement techniques for increased productivity due to information systems implementation.
- a. Measure increases in productivity realized by the implementation of information systems.
- 3 2 1 0 14. Explain new and emerging classes of software.
- a. Identify new and emerging classes of software.
- 3 2 1 0 15. Explain the benefits of hosting a web site on a local server vs. at an ISP (Internet Service Provider).
- a. Compare the advantages and disadvantages of running your own server vs. using a server provider.
- 3 2 1 0 16. Explain the differences between local and wide area networks.
- a. Distinguish between local area networks and wide area networks.
- 3 2 1 0 17. Explain the features and functions of web browsing software.
- a. Identify how different browsers affect the look of a web page.
- b. Demonstrate knowledge of the characteristics and uses of plug-ins.
- c. Demonstrate knowledge of the

- role of browsers in reading files on the World Wide Web (text-only, hypertext).
- 3 2 1 0 18. Explain the features and functions of web page design software.
- 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.
- Demonstrate knowledge of the function and operation of compilers and interpreters.
 - Demonstrate knowledge of widely used software applications (e.g., word processing, database management, spreadsheet development).
 - Demonstrate knowledge of the key functions of systems software.
- 3 2 1 0 20. Explain the role of number systems in information systems.
- Identify the role the binary system in information systems.
 - Demonstrate knowledge of number systems and internal data representation.
- 3 2 1 0 21. Gather information.
- Identify potential sources of information.
 - Gather information from selected print and electronic sources.
 - Conduct interviews with selected human information sources.
 - Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).
 - Target audience/user group as a key information source.
 - Determine priorities for the
- information that should be gathered.
- 3 2 1 0 g. Identify subject-matter experts.
- 3 2 1 0 22. Identify computer classifications and hardware.
- Identify types of computer storage devices.
 - Identify the hardware associated with telecommunications functions.
 - Identify major hardware components and their functions.
 - 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.
- Identify new technologies relevant to information technology.
 - Assess the importance of new technologies to future developments & to future knowledge worker productivity.
 - Identify new & emerging drivers and inhibitors of information technology change.
- 3 2 1 0 24. Monitor and adjust goals.
- Obtain support for goals.
 - Provide support for goals.
 - Monitor goal achievement.
 - Adjust goals.
- 3 2 1 0 25. Operate computer-driven equipment and machines.
- Run applications/jobs in accordance with processing procedures.
 - Secure needed supplies and resources.
 - Interact with/respond to system messages using console device.
 - 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.
- Customize software to meet user preferences.
- 3 2 1 0 27. Perform installation accurately and completely, using available resources as needed.
- Select appropriate installation options (e.g., default, customized).
 - Configure software to appropriate operating system settings.
 - Configure macros, tools, and packages to accomplish simple organizational and personal tasks.
 - Differentiate between procedures for an upgrade and for a new installation.
 - Differentiate between stand-alone and network installation procedures.
 - Disable/uninstall software that may interfere with installation of new software.
 - Install given application/system software on various platforms in accordance with manufacturer's procedures.
 - Convert data files if required.
 - Verify software installation and operation.
- 3 2 1 0 28. Resolve problems with installation if they occur.
- Access needed help using manufacturers' technical help lines or Internet sites.
 - Formulate new installation procedure if needed.
 - Troubleshoot unexpected results.
 - Set short- and long-term goals for

- assigned areas of responsibility/accountability.
- 3 2 1 0 29. Test and maintain products / services.
- Test products for reliability.
 - Initiate predictive maintenance procedures.
- 3 2 1 0 30. Troubleshoot computer-driven equipment and machines and access support as needed
- Test system using diagnostic tools/software.
 - Repair/replace malfunctioning hardware.
 - Reinstall software as needed.
 - Recover data and/or files.
 - Restore system to normal operating standards.
- 3 2 1 0 31. Understand and employ design and color principles.
- Assess the impact of various color harmonies on a two-dimensional picture plan.
 - Demonstrate knowledge of the two-dimensional picture plan.
 - Demonstrate knowledge of the nature of color and color harmonies.
 - Assess how color affects the principles of line, value, shape and form.
 - 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.
- Identify major current issues in data communications.
 - Identify data communication trends.
 - Demonstrate knowledge of data transmission codes and protocols.
- 3 2 1 0 33. Understand elements and types of information processing.
- Identify the elements of the information processing cycle (i.e., input, process, output, and storage).
- 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.
- Identify the ways in which organizational functions are interdependent.
 - Define the role of strategic planning in business.
 - Identify types of communication channels (e.g., formal, informal).
 - Demonstrate knowledge of the components of a business plan.
- 3 2 1 0 35. Understand how bandwidth affects data transmission and on-screen image.
- 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.
- Demonstrate knowledge of how data is organized in software development.
- 3 2 1 0 37. Understand information organization principles.
- Demonstrate knowledge of group support technology for common knowledge requirements.
 - Demonstrate knowledge of methods for achieving productivity in knowledge work.
 - Demonstrate knowledge of the information analysis process.
 - Demonstrate knowledge of information technology solutions.
- 3 2 1 0 38. Understand product/service design.
- Consider customer satisfaction in determining product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation).
 - Design product (e.g., using brainstorming, thumbnail sketches, rendering).
- 3 2 1 0 39. Understand the differences between a client and a server.
- Differentiate between a client and a server.
- 3 2 1 0 40. Understand the fundamentals of operating systems.
- Identify major operating system fundamentals and components.
- 3 2 1 0 41. Understand the range of languages used in software development.
- Demonstrate knowledge of the range of languages used in software development.
- 3 2 1 0 42. Understand types and functions of businesses.
- Define stakeholder relationships (e.g., customers, employees, shareholders, and suppliers).
 - Identify business reporting and information flow.
 - Identify types of business organizations and functions.
- 3 2 1 0 43. Use available reference tools as appropriate.
- Access needed information using appropriate reference materials.
 - Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts).
- 3 2 1 0 44. Use installation and operation manuals.
- Access needed information using appropriate reference materials.

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

TECHNICAL LEVEL COURSES

41010 Technical Introduction to Computer Science (Competencies not yet available)

41011 Computer Science & Software Engineering (Competencies not yet available)

41020 Computer Science Applications (Competencies not yet available)

APPLICATION LEVEL COURSES

41030 Simulation and Modeling (SAM)

(Competencies not yet available)

41036 Cybersecurity

(Competencies not yet available)

41034 Artificial Intelligence

(Competencies not yet available)

41037 Computational Problem Solving (CPS)

- 3 2 1 0 1. Demonstrate effective professional communication skills and practices that enable positive customer relationships
- 3 2 1 0 2. Use product or service design processes and guidelines to produce a quality information technology (IT or STEM) product or service
- 3 2 1 0 3. Demonstrate the use of cross-functional teams in achieving IT/STEM project goals
- 3 2 1 0 4. Demonstrate positive cyber citizenry by applying industry-accepted ethical practices and behaviors
- 3 2 1 0 5. Explain the implications of IT/STEM on business development
- 3 2 1 0 6. Describe trends in emerging and evolving computer technologies and their influence on IT/STEM practices
- 3 2 1 0 7. Perform standard computer backup and restore procedures to protect IT information

- 3 2 1 0 8. Recognize and analyze potential IT security threats to develop and maintain security requirements
- 3 2 1 0 9. Describe quality assurance practices and methods employed in producing and providing quality IT/STEM products and services
- 3 2 1 0 10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches
- 3 2 1 0 11. Demonstrate knowledge of the hardware components associated with information systems
- 3 2 1 0 12. Compare key functions and applications of software and determine maintenance strategies for computer systems

21048 STEM 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.

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.

Create/evaluate products/services using reliability factors.

d. Identify testing methodologies, and system analysis requirements.

- 3 2 1 0 3. Assess the importance of new technology to future developments.
- 3 2 1 0 4. Identify trends and major current issues associated with topic.
- 3 2 1 0 5. Demonstrate in depth knowledge resulting from the topic examined (presentation, demonstration, etc).

21205 Project Management and Resource Scheduling

- 3 2 1 0 1. Recognize different resource types (Work, Material, Cost, Budget, Personnel/Skills, Generic, etc)
- 3 2 1 0 2. Understand the concept of scope and demonstrate in context of assessing the size of a project.
- 3 2 1 0 3. Develop plans for project management and resource scheduling.
- 3 2 1 0 4. Identify key personnel and responsibilities for project.
- 3 2 1 0 5. Develop SWOT analysis [Strengths, Weaknesses, Opportunities, and Threats] for project.
- 3 2 1 0 6. Analyze workload of tasks and projects.

- 3 2 1 0 7. Determine required personnel groups and management hierarchy.
- 3 2 1 0 8. Determine resources necessary for project completion.
- 3 2 1 0 9. Determine essential tasks necessary for project completion.
- 3 2 1 0 10. Design potential timelines for assignments.
- 3 2 1 0 11. Explore appropriate technologies for project management and resource scheduling.
- 3 2 1 0 12. Create and present a project management and resource scheduling plan.
- 3 2 1 0 13. Create Gantt charts.
- 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