

INFORMATION TECHNOLOGY CAREER CLUSTER DESIGN

Programming and Software Development Pathway – CIP Code 11.0201

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.

INTRODUCTORY LEVEL

Computing Systems	10002/60002	1 credit
Computer Applications	10004/60004	1 credit

TECHNICAL LEVEL

Business Programming	10151	1 credit
Computer Programming	10152	1 credit
Visual Basic Programming	10153	1 credit
C++ Programming	10154	1 credit
Java Programming	10155	1 credit
Computer Prog.-Other Language	10156	1 credit
Database Applications	10053	1 credit
Web Page Design	10201	1 credit
Data Systems/Processing	10054	1 credit

APPLICATION LEVEL

AP Computer Science	10157	1 credit
IB Computing	10159	1 credit
Particular Topics in Computer Prog.	10160	1 credit
Computer Prog-Workplace Exp.	10198	1 credit
Game Design & Authoring for the Web	10165	1 credit
Computer Programming - Other	10199	1 credit
Project Mgmt. & Res Scheduling	21205	1 credit

KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE
 PROGRAMMING AND SOFTWARE DEVELOPMENT PATHWAY (C.I.P. 11.0201)

STUDENT _____
 Rating Scale:

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

INFORMATION TECHNOLOGY 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 –
 INFORMATION TECHNOLOGY CLUSTER
 STANDARDS**

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

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

INTRODUCTORY LEVEL COURSES

10004-Computer Applications

- 3 2 1 0
1. Personal Information Management
 - b. word usage, spelling, sentence structure, clarity, email
 - c. Demonstrate knowledge of email

- etiquette.
- d. Send email messages.
- e. Access email attachments.
- f. Attach documents to messages.
- g. Demonstrate knowledge of contamination protection strategies for email.
- h. Save email messages / attachments.

3 2 1 0 2. Research and Internet

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

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

3 2 1 0 3. Word Processing and Presentations

- a. Create documents (e.g., letters, memos, reports) using existing forms and templates.
- b. Employ word processing utility tools (e.g., spell checker, grammar checker, thesaurus).
- c. Format text using basic formatting functions.
- d. Retrieve existing documents.
- e. Safeguard documents using name & save functions.
- f. Create new word processing forms, style sheets, and templates.
- g. Enhance publications using different fonts, styles, attributes, justification, etc.

- h. Enhance publications using paint/draw functions.
- i. Format new desktop publishing files.
- j. Output desktop publishing files.
- k. Place graphics in document.
- l. Prepare publications using desktop publishing software.
- m. Use advanced formatting features (e.g., headers/footers/dropped caps, and indexing).
- n. Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication.
- o. Edit presentations.
- p. Insert graphic elements (e.g., graph, clip art, table) in a slide.
- q. Identify hardware items that support presentation software (e.g., scanners, digital cameras, printers, and projection systems).
- r. Print a single slide, an entire presentation, an outline, and notes.
- s. Run slide shows manually and automatically.

3 2 1 0 4. Spreadsheets

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

3 2 1 0 5. Data

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

commands used to handle tasks in operating systems.

- v. Differentiate between microcomputer, minicomputer, and mainframe operating systems.
- w. Demonstrate knowledge of the basics of process management.
- x. Demonstrate knowledge of the system utilities used for file management.

3 2 1 0 6. Ethics and Security

- a. Demonstrate knowledge of potential internal and external threats to security.
- b. Assess exposure to security issues.
- c. Demonstrate knowledge of virus protection strategy.
- d. Ensure compliance with security rules, regulations, and codes.
- e. Explore ways to implement countermeasures.
- f. Implement security procedures in accordance with business ethics.
- g. Maximize threat reduction.
- h. Document security procedures.
- i. Understand how to follow a disaster plan.
- j. Identify sources of virus infections.
- k. Understand how to utilize backup and recovery procedures.
- l. Understand how to load virus detection and protection software.
- m. Maintain confidentiality.
- 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).
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.
- 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.
- 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 14. Explain new and emerging classes of software.
- 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).
- 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.
- Distinguish between local area networks and wide area networks.
- 3 2 1 0 17. Explain the features and functions of web browsing software.
- Identify how different browsers affect the look of a web page.
 - Demonstrate knowledge of the characteristics and uses of plug-ins.
 - 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.
 - 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).
 - 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.
- 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.
- 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

12/3/2015

10151 Business Programming

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 18. Demonstrate knowledge of software development environment.

- 3 2 1 0 19. Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10152 Computer Programming

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.

- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19 Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10153 Visual Basic Programming

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.

- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 1 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19 Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.

- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10154 C++ Programming

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.

- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 1 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19 Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10155 Java Programming

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.

- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 1 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19 Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10156 Computer Programming – Other Language

- 3 2 1 0 1. Summarize the process of IT product/service design.

- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.
- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 1 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19 Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.

- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10053 Database Applications

- 3 2 1 0 1. Develop programs using appropriate language.
- 3 2 1 0 2. Use user interface development tools.
- 3 2 1 0 3. Identify the use of program design tools in a software development process.
- 3 2 1 0 4. Demonstrate knowledge of how a programming language can support multitasking and exception- handling.
- 3 2 1 0 5. Demonstrate knowledge of the basic principles for analyzing a programming language.
- 3 2 1 0 6. Demonstrate knowledge of the basics of structured, object-oriented language.
- 3 2 1 0 7. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 8. Demonstrate knowledge of current key programming languages and the environment they are used in.
- 3 2 1 0 9 Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 10. Translate data structure and program design into code in an appropriate language.
- 3 2 1 0 11. Demonstrate knowledge of how programming control structures are used to verify correctness.

- 3 2 1 0 12. Demonstrate knowledge of how to design and implement programs in a top-down manner.
- 3 2 1 0 13. Demonstrate knowledge of structured/modular programming.
- 3 2 1 0 14. Divide design specifications into logical process blocks.
- 3 2 1 0 15. Follow specifications or drawings.
- 3 2 1 0 16. Identify parameters.
- 3 2 1 0 17. Create a database from model specifications using both program code and Graphic User Interface (GUI) processes when provided by the database
- 3 2 1 0 18. Perform standard maintenance on the database.
- 3 2 1 0 19. Release software and documentation updates according to procedures.
- 3 2 1 0 20. Develop scripts and forms that permit access via websites to the database.
- 3 2 1 0 21. Identify and analyze potential security problems for web access to the database.
- 3 2 1 0 22. Implement solutions in code and documentation.
- 3 2 1 0 23. Propose security solutions to web-based security problems.

10201 Web Page Design

- 3 2 1 0 1. Develop flowchart, navigational blueprints and schema.
- 3 2 1 0 2. Create sample design showing placement of buttons/navigational graphics and suggested color scheme.
- 3 2 1 0 3. Develop storyboards.
- 3 2 1 0 4. Demonstrate knowledge of available graphics, video, motion graphics, web software programs.

- 3 2 1 0 5. Identify how different user agents (browsers, devices) affect the digital communication product.
- 3 2 1 0 6. Create and produce content.
- 3 2 1 0 7. Create and refine design concepts.
- 3 2 1 0 8. Identify, utilize and create reusable components.
- 3 2 1 0 9. Apply color theory to select appropriate colors.
- 3 2 1 0 10. Apply knowledge of typography.
- 3 2 1 0 11. Apply principles and elements of design.
- 3 2 1 0 12. Evaluate visual appeal.
- 3 2 1 0 13. Demonstrate knowledge of basic web application security.
- 3 2 1 0 14. Demonstrate knowledge of HTML, XHTML, and CSS.
- 3 2 1 0 15. Explain importance of web standards.
- 3 2 1 0 16. Demonstrate knowledge of Web 2.0.
- 3 2 1 0 17. Explain the importance of ethical behaviors and legal issues.
- 3 2 1 0 18. Demonstrate knowledge of how to use a scripting language to program a site.
- 3 2 1 0 19. Describe the function of a non-disclosure agreement (NDA).
- 3 2 1 0 20. Differentiate between copyright and trademarks.
- 3 2 1 0 21. Explain the concept of intellectual property.
- 3 2 1 0 22. Define scope of work to achieve individual and group goals.
- 3 2 1 0 23. Use available reference tools as appropriate.
- 3 2 1 0 24. Explain the features and functions of Web browsing software.
- 3 2 1 0 25. Explain the features and functions of Web page design software.

- 3 2 1 0 26. Compare and contrast clients and servers.
- 3 2 1 0 27. Describe how bandwidth affects data transmission and on-screen image.

10054 Data Systems / Processing

- 3 2 1 0 1. Demonstrate knowledge of hard drive technologies (IDE, EIDE, SATA, SCSI, etc).
- 3 2 1 0 2. Demonstrate knowledge of I/O ports (serial, parallel, USB, PS/2, Firewire, etc).
- 3 2 1 0 3. Demonstrate knowledge of INPUT devices (keyboard, mouse, touchpad, cameras, scanners, midis, barcode scanners, etc).
- 3 2 1 0 4. Demonstrate knowledge of OUTPUT devices (printers, CRTs, LCD monitors, network devices).
- 3 2 1 0 5. Demonstrate knowledge of how a programming language can support multitasking and exception- handling.
- 3 2 1 0 6. Demonstrate knowledge of the basic principles for analyzing a programming language.
- 3 2 1 0 7. Demonstrate knowledge of the basics of structured, object-oriented language.
- 3 2 1 0 8. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 9. Demonstrate knowledge of the hardware-software connections.
- 3 2 1 0 10. Demonstrate knowledge of current key programming languages and the environment they are used in.
- 3 2 1 0 11. Demonstrate knowledge of key constructs and commands specific to a language.

- 3 2 1 0 12. Translate data structure and program design into code in an appropriate language.
- 3 2 1 0 13. Demonstrate knowledge of the range of languages used in software development.
- 3 2 1 0 14. Analyze and prepare logic using at least one alternative to flowcharting such as pseudo coding.
- 3 2 1 0 15. Analyze and prepare logic using program flowchart.
- 3 2 1 0 16. Compile and debug code.
- 3 2 1 0 17. Conduct unit testing and bug fixes.
- 3 2 1 0 18. Prepare code documentation.
- 3 2 1 0 19. Prepare unit testing plan.
- 3 2 1 0 20. Review design (e.g., peer and/or user walkthrough).
- 3 2 1 0 21. Use appropriate programming language.

APPLICATION LEVEL COURSES

10157 AP Computer Science

- 3 2 1 0 1. Object-Oriented Program Design
 - a. Program design
 - Read and understand a problem description, purpose, and goals. Apply data abstraction and encapsulation.
 - Read and understand class specifications and relationships among the classes “is-a,” “has-a” relationships).
 - Understand and implement a given class hierarchy.
 - Identify reusable components from existing code using classes and class libraries.
 - b. Class design

Design and implement a class. Choose appropriate data representation and algorithms. Apply functional decomposition. Extend a given class using inheritance.

- 3 2 1 0 2. Program Implementation
 - a. Implementation Techniques
 - Methodology – Object-oriented development, Top-down development, Encapsulation & information hiding, Procedural abstraction
 - b. Programming Constructs
 - Primitive types vs. objects
 - Declaration – Constant declarations, Variable declarations, Class declarations, Interface declarations, Method declarations, Parameter declarations, Console output (System out, print/println), Control, Methods, Sequential, Conditional, Iteration, Understand & Evaluate recursive methods
 - c. Java Library classes (included in the AP Java subset)
- 3 2 1 0 3. Program Analysis
 - a. Testing
 - Test classes and libraries in isolation. Identify boundary cases and generate appropriate test data.
 - Perform integration testing.
 - b. Debugging
 - Categorize errors: compile-time, run-time, logic.
 - Identify & correct errors.
 - Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code.
 - c. Understand and modify existing code
 - d. Extend existing code using inheritance

- e. Understand error handling (Understand runtime exceptions)
 - f. Reason about programs
Pre- and post-conditions
Assertions
 - g. Analysis of algorithms
Informal comparisons of running times
Exact calculation of statement execution counts
 - h. Numerical representations and limits
Representations of numbers in different bases
Limitations of finite representations (e.g., integer bounds, imprecision of floating-point representations and round-off error)
- 3 2 1 0 4. Standard Data Structures
- a. Simple data types (int, boolean, double)
 - b. Classes
 - c. Lists
 - d. Arrays
- 3 2 1 0 5. Standard Algorithms
- a. Operations on data structures previously listed
Traversals, Insertions, Deletions
 - b. Searching
Sequential, Binary
 - c. Sorting
Selection, Insertion, Mergesort
- 3 2 1 0 6. Computing in Context
- a. System Reliability
 - b. Privacy
 - c. Legal issues and intellectual property
 - d. Social & ethical ramifications of computer use

10159 IB Computing

Core Topics

- 3 2 1 0 1. Computing System Fundamentals
- a. Learning Java - basics: data members, applets, simple data types, simple constructs, programming style.
 - b. Sequence, selection and repetition in depth.
 - c. Methods and parameters
- 3 2 1 0 2. Networks
- a. Mini project - usability issues
- 3 2 1 0 3. Computer Systems
- a. Classes
 - b. Applications,
 - c. OOP/Design/Programming Concepts
 - d. Testing solutions
 - e. File Management
- 3 2 1 0 4. System Life Cycle
- a. Preparation for dossier project
- 3 2 1 0 5. Algorithms
- a. Dossier work
- 3 2 1 0 6. The Case Study
- a. Dossier work
- 3 2 1 0 7. Algorithm practice with JETS

Higher Level Program

- 3 2 1 0 8. Computing System Fundamentals
- a. Learning Java – basics: data members, applets, simple data types, simple constructs, programming style
- 3 2 1 0 9. Computing Systems and Further Fundamentals
- a. Methods and parameters
 - b. Classes
 - c. Applications, event driven and OOP concepts
- 3 2 1 0 10. Networks
- a. Mini project – usability issues
- 3 2 1 0 11. Computer Math and Logic
- a. Arrays, records. Testing solutions
 - b. Mini-project, design & test

- 3 2 1 0 12. Algorithms and data structures (stacks, queues, trees, lists) recursion, File organization
- a. Files, ADT's, recursion
 - b. Preparations for dossier project
- 3 2 1 0 13. Algorithms
- a. Dossier work
- 3 2 1 0 14. The case study
- a. Dossier work
- 3 2 1 0 15. Algorithm Practice with JETS

10160 Particular Topics in Computer Programming

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

Possible topics (you will have others):

**Data Structures
Object Characteristics &
Methods Advanced
Algorithms**

- 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.

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

- 3 2 1 0 1. Summarize the process of IT product/service design.

- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors
- 3 2 1 0 4. Test new products/services for reliability
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 13 2 1 0 6. Identify input and output requirements,
- 3 2 1 0 7. Identify system processing requirements.
- 3 2 1 0 8. Define scope of work to meet customer needs.
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product.
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19. Develop programs using appropriate language.

- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language.
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

10198 Computer Programming – 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.

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

10165 Game Design & Authoring the Web

- 3 2 1 0 1. Summarize the process of IT product/service design.
- 3 2 1 0 2. Plan for products/services using reliability factors.
- 3 2 1 0 3. Create products/services using reliability factors.

- 3 2 1 0 4. Test new products/services for reliability.
- 3 2 1 0 5. Maintain the reliability of new products/services.
- 3 2 1 0 6. Identify input and output requirements
- 3 2 1 0 7. Identify system processing requirements
- 3 2 1 0 8. Define scope of work to meet customer needs
- 3 2 1 0 9. Demonstrate knowledge of the key functions and subsystems of the software product
- 3 2 1 0 10. Demonstrate knowledge of cross-functional team structures and team members' roles.
- 3 2 1 0 11. Assess the importance of new technology to future developments.
- 3 2 1 0 12. Identify data communication trends and major current issues.
- 3 2 1 0 13. Identify new technologies relevant to information technology.
- 3 2 1 0 14. Identify system processing requirements.
- 3 2 1 0 15. Determine compatibility of hardware and software.
- 3 2 1 0 16. Identify new and emerging classes of software.
- 3 2 1 0 17. Identify the elements of the information processing cycle (i.e., input, process, output, storage)
- 3 2 1 0 18. Demonstrate knowledge of software development environment.
- 3 2 1 0 19. Develop programs using appropriate language.
- 3 2 1 0 20. Demonstrate knowledge of the information system life cycle.
- 3 2 1 0 21. Demonstrate knowledge of the concepts of data and procedural representations.
- 3 2 1 0 22. Demonstrate knowledge of key constructs and commands specific to a language
- 3 2 1 0 23. Demonstrate knowledge of how programming control structures are used to verify correctness.

- 3 2 1 0 24. Demonstrate Understanding of Gaming Framework Basics
 - a. Creating 3D objects
 - b. Handling input to move our camera
- 3 2 1 0 25. Utilize Content Pipeline
 - a. Loading & Texturizing 3D Objects
 - b. Sound and Music
 - c. Extending the content pipeline
- 3 2 1 0 26. Demonstrate usage of 2D Objects and Effects
 - a. 2D Basics
 - b. 2D Effects
 - c. Creating a 2D game
- 3 2 1 0 27. Program Handheld Devices (or simulated environment)
 - a. Programming for the Handheld
 - b. Running the game on the handheld
- 3 2 1 0 28. Utilize High Level Shader Language
 - a. HLSL Basics
 - b. Advanced HLSL
- 3 2 1 0 29. Utilize Physics and Artificial Intelligence
 - a. Physics Basics
 - b. Finite State Machines and Game State Management
 - c. AI Algorithms
- 3 2 1 0 30. Utilize 3D Effects
 - a. Advanced Texturing Techniques
 - b. Special Effects
 - c. Particle System
- 3 2 1 0 31. Demonstrate Successful Debugging
 - a. Creating a 3D Game
 - b. Improving the Game
 - c. Finishing Touches
- 3 2 1 0 32. Demonstrate Understanding of Networking Framework
 - a. Networking Basics
 - b. Creating Multiplayer Demos
 - c. Creating a Networking Game Skeleton

- d. D. Creating a Turn-based Multiplayer Game
- e. Creating a Real-time Multiplayer Game

10199 Computer Programming – Other

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

- 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.

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

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.