State of Illinois
Model Programs of Study Guide:
Information Technology

October 2020

ICCB
ILLINOIS COMMUNITY COLLEGE BOARD

Education Systems Center
NORTHERN ILLINOIS UNIVERSITY

About ICCB

In 1965, the Illinois General Assembly established the Illinois Community College Board to create a system of public community colleges that would be within easy reach of every resident. Today, the Illinois Community College System covers the entire state with 48 colleges and one multi-community college center in 39 community college districts. Community colleges serve nearly one million Illinois residents each year in credit and noncredit courses and many more through their public service programs.

Illinois' community colleges meet both local and statewide needs for education and workforce development through high-quality, affordable, accessible, and cost-effective programs and services. Learn more at iccb.org.

About Education Systems Center

Education Systems Center (EdSystems) is a mission-driven policy development and program implementation center based within Northern Illinois University's Division of Outreach, Engagement, and Regional Development. EdSystems' mission is to shape and strengthen education and workforce systems that prepare more young people for productive careers and lives in a global economy. EdSystems leads and manages the Illinois P-20 Council's College and Career Readiness Committee, which recently drove the development and adoption of the Postsecondary and Workforce Readiness Act (pwract.org). Learn more about EdSystems at edsystemsniu.org.
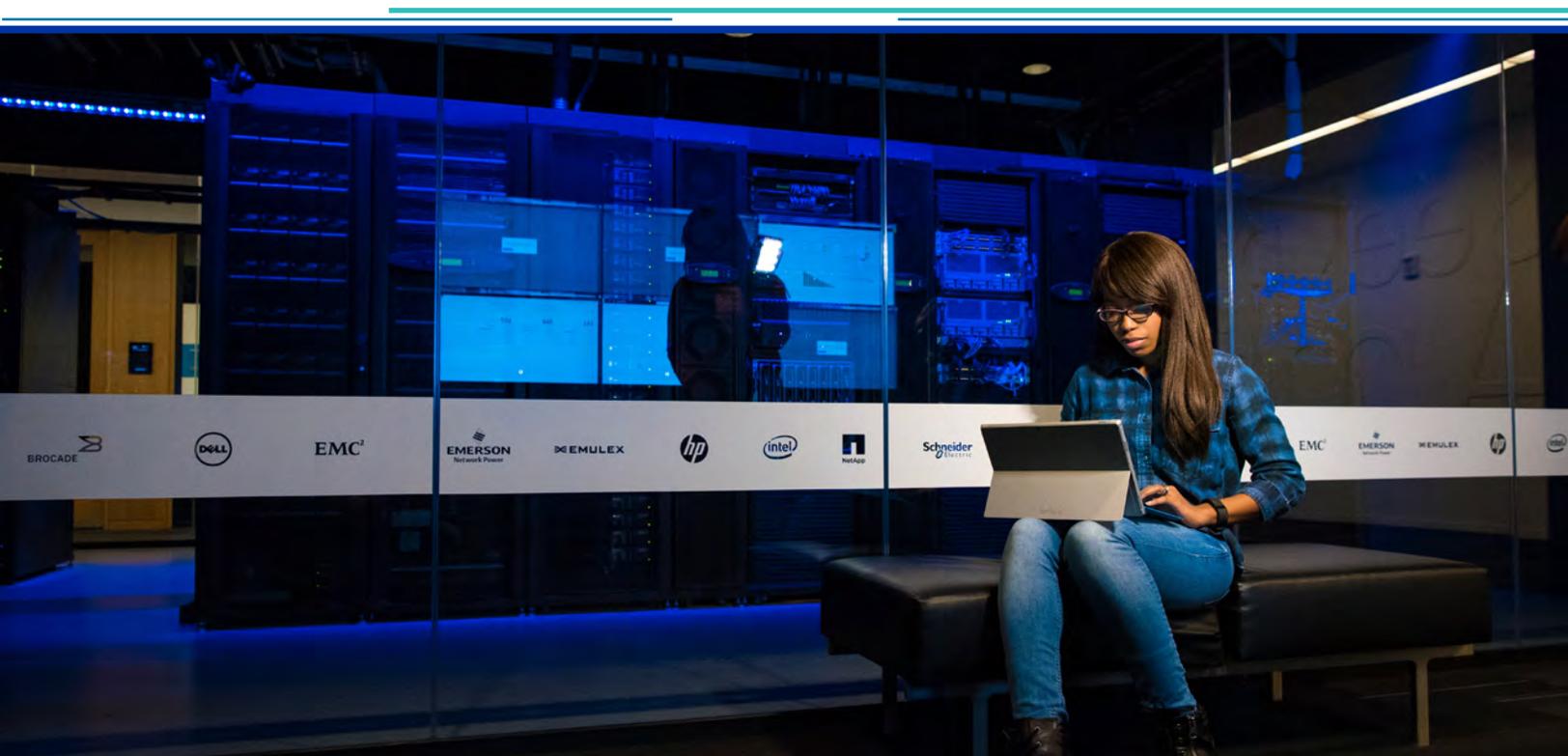
About the Model Programs of Study Guide

The Illinois Community College Board (ICCB) sponsored the development of Model Programs of Study Guides in crucial industry areas as part of the Illinois State Plan for Strengthening Career and Technical Education for the 21st Century Act (also known as the Perkins V Plan). This Guide was developed in consultation and collaboration with the Illinois State Board of Education (ISBE) through a process led and facilitated by Education Systems Center at NIU (EdSystems). As further detailed in this Guide, the process involved extensive research into labor market information and credential programs, and dialogue across secondary, postsecondary, and employer stakeholders.

The primary purposes and goals for the Model Programs of Study are to:

1. **Provide guidance and exemplars** for local programs to adopt or customize as they develop programs of study for approval as part of the Perkins V Plan.

2. **Establish a framework** for State agencies to develop and implement program supports.

3. **Identify priority dual credit courses** that are foundational to the industry area and well-situated for statewide scaling and articulation.

4. **Define the competencies** that should be sequenced across a program of study course sequence to prepare students for the future of work in that industry area.

5. **Identify entry points** for employers to support coursework and related experiences.

Model Programs of Study supplement and complement other State of Illinois career and technical education and career pathway resources, including the ISBE Career Guide, State of Illinois Career Pathways Dictionary, Career Development Experience Toolkit, Postsecondary and Workforce Readiness Act Recommended Technical and Essential Employability Competencies, State of Illinois Workforce Development Strategic Plan, Workforce Education Strategic Plan, and related state and regional data resources. School districts, community colleges, and their partners are encouraged to use this Guide, state resources, and local program and course information to develop materials for student and family outreach.

The full Model Programs of Study for Information Technology, depicted graphically on pp. 4 – 5, can be used as a reference in local planning processes. The Guide then presents and describes in detail each component of the sequence, including descriptions of the underlying research, analysis, and Advisory Committee input leading to each component:

Appendix A includes the PWR Act Recommended Technical Competencies for Health Sciences and the recommended Essential Employability Competencies. Appendix B includes the Advisory Committee membership.

Model Programs of Study Guide:
Information Technology

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	ORIENTATION / INTRODUCTION Grades 9–10	SKILL DEVELOPMENT Grades 10–12	CAPSTONE / ADVANCED Grades 12	POSTSECONDARY COURSES Recommended 1st Year
CAREER FOCUSED COURSES *Information Technology* *Programming* *Networking*	Computer Applications for Business	Intro to Computer Info Systems *or* AP Computer Science Principles ⟫ — Mobile Application / Web Development Course(s) — Hardware / Operating System Course(s) Aligned with IT Certification ✓	Computer Science I *or* AP Computer Science A ⟫ — Intro to Networking Aligned with IT Certification ✓	Computer Science I — Computer Science II — Intro to Web Development — Continue AS or AAS Course Sequence Aligned with IT Certification ✓

Courses and Work-Based Learning Address the PWR Act Recommended Technical and Essential Employability Competencies

WORK-BASED LEARNING	Career Exploration (2) — Team-Based Challenge	Team-Based Challenge — Career Development Experience *or* Youth Apprenticeship		Team-Based Challenge — Career Development Experience *or* Apprenticeship
SCIENCE	Science Sequence	Science Sequence	Science ⟫	Science
SOCIAL SCIENCE	Social Science Sequence	Social Science Sequence	Social Science ⟫	Social Science
MATH	Algebra — Geometry	Geometry — Algebra 2 — Pre-Calculus	Transitional Math: STEM — College Algebra — Pre-Calculus — Calculus ⟫ — Statistics ⟫	College Algebra — Calculus — Statistics
ENGLISH	English Sequence	English Sequence	Transitional English — English Composition ⟫	English Composition — Oral Communication

⟫ **AP or Dual Credit**

📄 **Dual Credit Course**

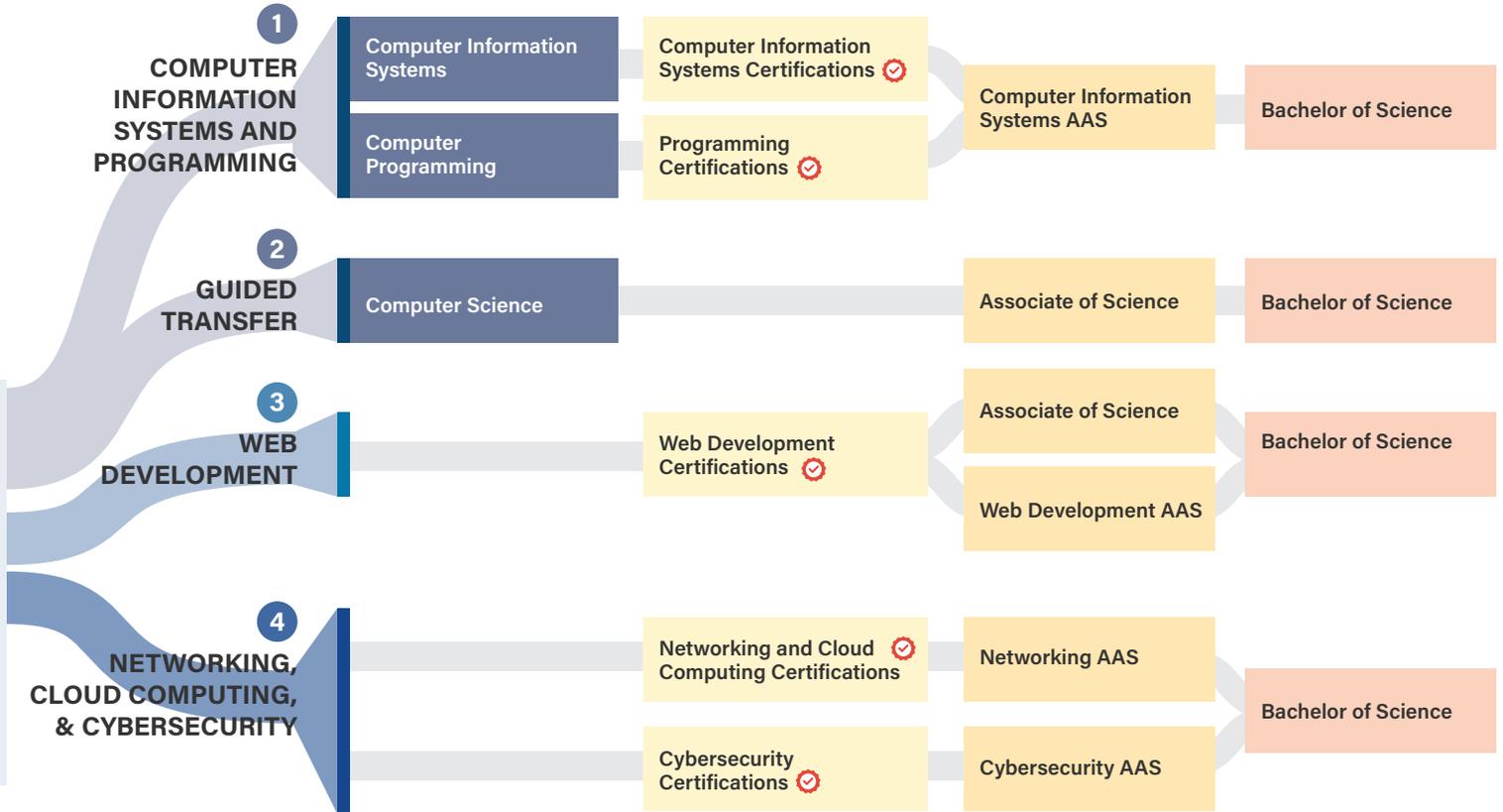📄✓ **Dual Credit Course Affiliated With IAI Code**

✓ **Course or Program Prepares for Industry Credential**

📄✓ **Postsecondary Course Affiliated with IAI Code**

🏅 **College and Career Pathway Endorsement Earned**

⊕ *If courses in this column were accomplished through early college credit, students should take the next required course in the sequence or, if none, additional AAS or Major Courses*

POSTSECONDARY OPTIONS

1 COMPUTER INFORMATION SYSTEMS AND PROGRAMMING
- Computer Information Systems → Computer Information Systems Certifications ✓ → Computer Information Systems AAS → Bachelor of Science
- Computer Programming → Programming Certifications ✓ → Computer Information Systems AAS → Bachelor of Science

2 GUIDED TRANSFER
- Computer Science → Associate of Science → Bachelor of Science

3 WEB DEVELOPMENT
- Web Development Certifications ✓ → Associate of Science → Bachelor of Science
- Web Development Certifications ✓ → Web Development AAS → Bachelor of Science

4 NETWORKING, CLOUD COMPUTING, & CYBERSECURITY
- Networking and Cloud Computing Certifications ✓ → Networking AAS → Bachelor of Science
- Cybersecurity Certifications ✓ → Cybersecurity AAS → Bachelor of Science

SELECTED OCCUPATIONS, WAGES, & JOB GROWTH

Program	Typical Job	Near or Above Living Wage Threshold for 1 Adult + 1 Child [1]	Median Hourly Wage [2]	Growth in Illinois: Annual Job Openings [2]	Growth in Illinois: % Change Over 10 years [2]	Stackable?
1 Computer Information Systems and Programming	Computer Systems Analysts	Y	$41.67	2,230	9%	
	Computer User Support Specialists	Y	$24.27	220	11%	
2 Computer Science	Computer and Information Systems Managers	Y	$65.12	1,370	10%	Typically Stacks to Bachelor's Program
	Computer Hardware Engineers	Y	$50.35	110	12%	
	Software Developers - Applications	Y	$45.88	2,690	28%	
	Software Developers - Systems Software	Y	$51.63	1,030	13%	
	Computer and Information Research Scientists	Y	$55.43	90	21%	
3 Web Development	Web Developers	Y	$33.85	515	15%	
4 Networking, Cloud Computing, and Cybersecurity	Computer Network Architects	Y	$56.07	400	7%	
	Information Security Analysts	Y	$46.13	430	23%	
	Network and Computer Systems Administrators	Y	$39.87	970	5%	
	Computer Network Support Specialists	Y	$29.80	840	8%	

1. Living wage calculations are based on MIT's Living Calculator (livingwage.mit.edu), where the "Living Wage" for 1 Adult + 1 Child is $26.27/hour for the state of Illinois. "Near" defined as 85% of the statewide living wage, which is $22.33/hour
2. U.S. Department of Labor, CareerOnestop (careeronestop.org/explorecareers)

Background and Process for Developing Model Programs of Study

Programs of study are a coordinated, non-duplicative sequence of academic and technical content at the secondary and postsecondary levels that culminate in a recognized postsecondary credential. In Illinois, Perkins V programs of study are aligned with broader State policy goals to promote college and career readiness, including the State of Illinois' ESSA plan (in particular, the College and Career Readiness Indicator), the College and Career Pathway Endorsement framework and other elements of the Postsecondary and Workforce Readiness Act, the Dual Credit Quality Act, the Illinois WIOA Unified State Plan, and the State's Career Pathways Dictionary.

Process for Development

Each Model Programs of Study was developed using a data-driven, backward-mapping approach that extended from the areas of job growth down through to the high school course sequence. The specific steps in this analysis included:

1. **Identifying high-priority occupations** in the industry sector that are high-skill, high-wage, and in-demand based on federal Department of Labor data for the State of Illinois.

2. **Identifying promising postsecondary credentials** (degrees or certificates) that are broadly accessible through the Illinois community college system and lead to high-priority occupations.

3. **Mapping the stackable degrees and certificates** that progress to promising credentials.

4. **Identifying strategic community college courses** that appear across the maximum number of promising credentials, provide a broad foundation of knowledge essential to that industry sector, and are feasible for dual credit delivery.

5. **Mapping a course sequence from secondary through the first year of postsecondary** that incorporates strategic early college credit (including at least six early college credits in the career-focused course sequence) and considers industry trends and innovations in career and technical education.

6. **Defining related technical competencies** for the foundational program of study courses that can be utilized to guide course development and postsecondary articulation.

| IDENTIFY HIGH-PRIORITY OCCUPATIONS | DETERMINE PROMISING CREDENTIALS & MAP STACKABLE DEGREES/ CERTIFICATES | IDENTIFY STRATEGIC COMMUNITY COLLEGE COURSES | MAP SECONDARY TO POSTSECONDARY SEQUENCE | DEFINE RELATED TECHNICAL COMPETENCIES |

Using Department of Labor[1] data and the MIT Living Wage Calculator[2] for the State of Illinois as a reference, the project team identified "high-priority occupations" as jobs with a positive growth outlook and median salaries near or greater than the living wage for one adult and one child[3]. Thus, a "promising credential" is a degree or college certification that immediately prepares an individual for entry into a high-priority occupation or is a stackable credential for a high-priority occupation.

After identifying the promising credentials in each industry area, the project team analyzed community college programs leading to these credentials from a sampling of six to ten colleges from across Illinois, representing a mix of urban, suburban, and rural institutions[4]. EdSystems analyzed and categorized all of the career-focused and general education courses across the full sampling of the promising credential programs to determine which of these courses:

- Are most common across all programs in the sample,

- Are broadly accessible for dual credit opportunities considering prerequisites and teacher credentialing requirements, and

- Are included within the Illinois Articulation Initiative.

This analysis and categorization process led to a recommended set of "strategic" career-focused and general education courses that provide a critical foundation for the program of study sequence.

Following this internal analysis, EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the recommendations and provide expertise and guidance on the development of the Model Programs of Study (see Advisory Committee listing in Appendix B). Over multiple webinars and feedback sessions across four months, the Advisory Committee and smaller working groups provided information about industry trends that may not be reflected in the Department of Labor data, credentials and degrees that are emerging as most promising in the field, on-the-ground implementation considerations for secondary and postsecondary programs, and future of work implications for the sector. The Advisory Committee further informed important decision-points in the Model Program of Study process, including adjusting the Model of Program of Study course map and promising credential endpoints, selecting strategic early college credit courses, and identifying key competencies for target courses in the Model Program of Study currently lacking current statewide articulation. The culmination of EdSystems' analysis and the input of the Advisory Committee is reflected in the draft Model Programs of Study and course competencies included within this Guide.

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[1] U.S. Department of Labor, Career Onestop: careeronestop.org/ExploreCareers/explore-careers.aspx
[2] livingwage.mit.edu
[3] "Living Wage" for 1 Adult + 1 Child is $26.27/hour for the whole state of Illinois. "Near" is defined as 85% of the statewide living wage, which is $22.33/hour
[4] For the analysis of Information Technology, the community colleges surveyed were City Colleges of Chicago, Elgin Community College, Harper College, Heartland Community College, Illinois Central College, Joliet Junior College, Rock Valley College, and Sauk Valley Community College

Priority Occupations and Promising Credentials in Information Technology

Information Technology (IT) is a diverse industry poised for growth in Illinois. The State's five-year Economic Development Plan, released in 2019, cites disciplines ranging from data processing to computer programming to web design where jobs are projected to rise in an increasingly interconnected economy[5]. Supply is rising to meet current demand, with Illinois community colleges graduating nearly 6,000 IT graduates, across more than 400 certificate and degree programs, over the past three years[6]. Work remains, however, to ensure that the State can prepare today's learners with the fundamental and technical skills to contribute in an evolving IT industry where fields emerge and fade , and where algorithms and artificial intelligence continue to grow in influence. The COVID-19 pandemic and its developing impacts only compound these challenges.

Promising Credential Program Categories

The project team's analysis of promising credentials in the IT sector led to an identification of four overarching areas:
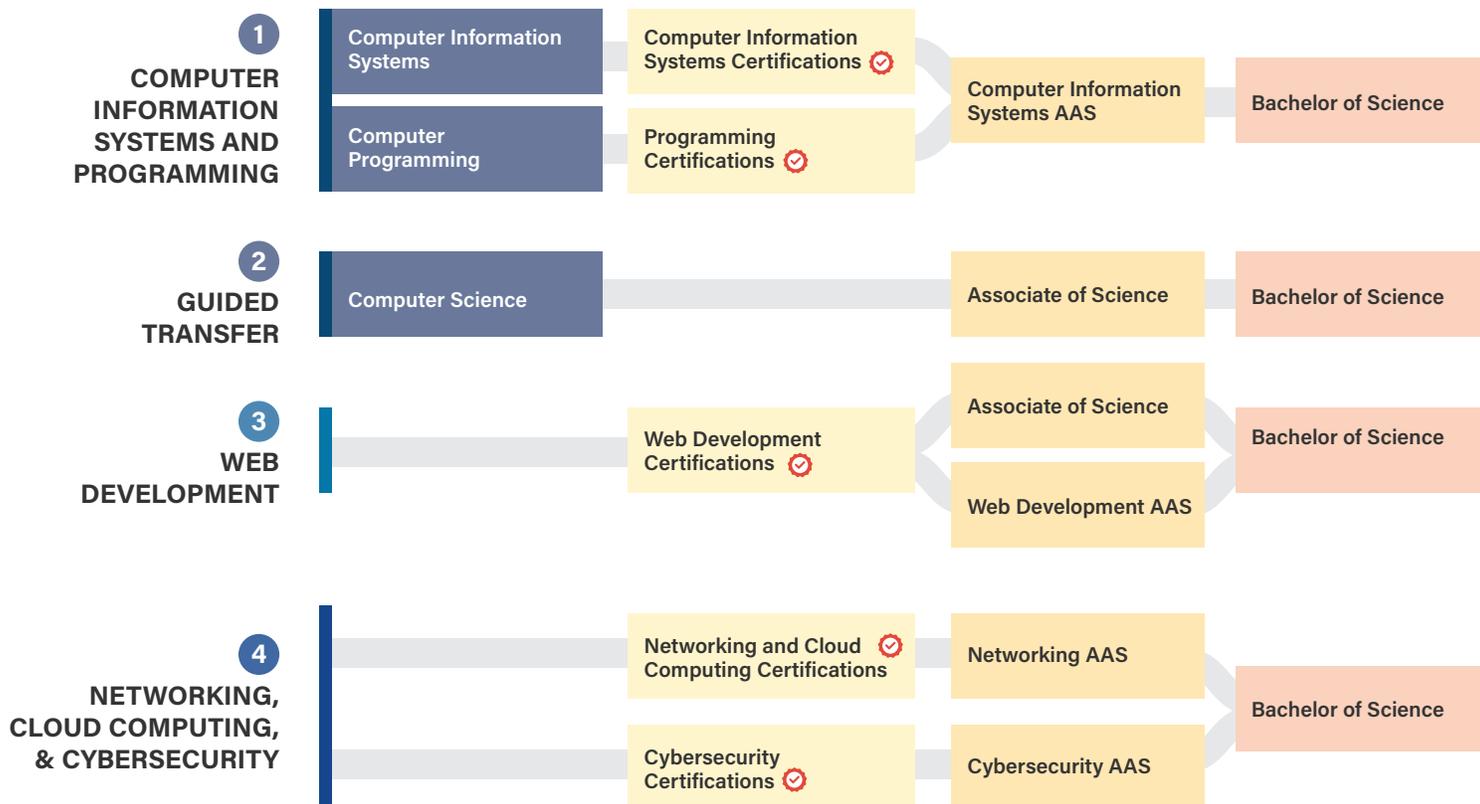
1. **Computer Information Systems and Programming** credentials leading to jobs like Quality Assurance tester or Database Administrator.

2. **Guided Transfer Computer Science** guided transfer programs towards bachelor's degrees and careers across computer science and software development.

3. **Web Development** credentials leading to jobs like Web Developer or Web Administrator.

4. **Networking, Cloud Computing, and Cybersecurity** credentials leading to jobs like Network Administrator and Network Support Specialist.

High-Priority Occupations

The Select Occupations, Wages, & Job Growth table identifies selected high priority occupations associated with each focus area. Occupations associated with Computer Information Systems and Programming, Guided Transfer Computer Science, Web Development, and Networking,

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POSTSECONDARY OPTIONS

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- Computer Information Systems
- Computer Programming
- Computer Information Systems Certifications
- Programming Certifications
- Computer Information Systems AAS
- Bachelor of Science

2 GUIDED TRANSFER
- Computer Science
- Associate of Science
- Bachelor of Science

3 WEB DEVELOPMENT
- Web Development Certifications
- Associate of Science
- Web Development AAS
- Bachelor of Science

4 NETWORKING, CLOUD COMPUTING, & CYBERSECURITY
- Networking and Cloud Computing Certifications
- Cybersecurity Certifications
- Networking AAS
- Cybersecurity AAS
- Bachelor of Science

Cloud Computing and Cybersecurity all met both the living wage criteria described in Section I. In Illinois, the occupations with the highest projected growth in terms of number of openings over the next decade are Software Developer – Applications (Guided Transfer Computer Science), with an estimated 2,690 annual openings; Computer Systems Analyst (Computer Information Systems and Programming), with an estimated 2,230 annual openings; and Computer and Information Systems Manager (Guided Transfer Computer Science), with an estimated 1,370 annual openings. Occupations with highest projected growth in percentage change over the next decade include Software Developer – Applications (Guided Transfer Computer Science), with estimated growth of 28 percent; Information Security Analyst (Networking, Cloud Computing, and Cybersecurity), with estimated growth of 23 percent; and Computer and Information Research Scientist (Guided Transfer Computer Science), with estimated growth of 21 percent[7].

The IT industry is rapidly developing, and occupations continue to emerge. Analysis and consultation of the Advisory Committee indicates that occupations such as Cloud Data Architect or Artificial Intelligence Researcher could meet both living wage and high growth criteria in Illinois. However, these occupations and others do not currently have an affiliated profile from the U.S. Department of Labor and thus are not included in the high priority occupations identified in the Select Occupations, Wages, & Job Growth table. They also could require a bachelor's degree or greater and thus serve as extensions of the Model Programs of Study focus areas.

Levels of Education Needed

Each of the focus areas in the Model Programs of Study for Information Technology incorporates stackable credentials and can lead to a bachelor's degree. The pathways in Computer Information Systems and Programming, Web Development, and Networking, Cloud

SELECTED OCCUPATIONS, WAGES, & JOB GROWTH

	Program	Typical Job	Near or Above Living Wage Threshold for 1 Adult + 1 Child	Median Hourly Wage	Growth in Illinois: Annual Job Openings	Growth in Illinois: % Change Over 10 years	Stackable?
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2. U.S. Department of Labor, CareerOnestop (careeronestop.org/explorecareers)

Computing, and Cybersecurity all include paths to various industry-recognized certificates, an Associate of Applied Sciences (AAS) degree or a Guided Transfer Associate of Science (AS) degree. These credential types offer students the means and flexibility to enter industry directly from their postsecondary experience.

Several public Illinois universities offer Bachelor of Arts or Bachelor of Science (BS) degrees and concentrations in Computer Information Systems, Web Development, or similar areas. These degree programs vary in name—from Information Technology to Cybersecurity—and focus. Whenever possible, community colleges should ensure that IT-related AAS degrees align with bachelor's options. Similarly, Programming certificates and relevant AAS degrees serve as technical foundations for further study, across programs, at the bachelor's level.

Many entry-level occupations in computer science and other computational fields require a BS degree. Most public universities in the state offer a Computer Science BS, and some offer bachelor's programs in data science or analytics. These related paths are depicted in the Model as a Guided Transfer Computer Science from an AS to a BS degree. The Web Development focus area also offers an AS-to-BS option.

AAS-to-BS articulation options in Networking, Cloud Computing, and Cybersecurity are currently developing. As noted, some explicit Cybersecurity BS degree programs are available. The Model Programs of Study map includes a BS option for this broad area with the expectation that additional options will be available to students soon at selected institutions in Illinois.

The Model Programs of Study recommend all IT students build a combination of credentials and academic and work-based experience. For those intending to pursue a bachelor's degree, students in the Computer Information Systems and Programming, Web Development, and Networking, Cloud Computing, and Cybersecurity pathways may need targeted instructional supports in mathematics to complete the math sequence requirements typical of BS degrees.

Advisory Committee Considerations

Across the four focus areas, the Advisory Committee highlighted the diversity of IT occupations, with many blended roles and skill sets. Committee members emphasized the necessity of solid foundations in mathematics and statistics as well as reading comprehension regardless of area or occupation. They noted the value that certifications and work-based learning experiences—whether through industry credentials, prior learning assessments (PLA), or otherwise—can add for high school students. They stressed the importance of foundational skills and adaptive competencies like critical thinking, ethical thinking, problem solving, creativity, and others that will be vital for learners in a rapidly evolving IT industry and broader economy. These considerations are reflected in the course sequences and competencies included in the Model Programs of Study, as detailed in the Programs of Study Description (following).

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[5] State of Illinois Department of Commerce and Economic Opportunity. A Plan to Revitalize the Illinois Economy and Build the Workforce of the Future. October 2019. P. 50. Retrieved May 27, 2020, from illinois.gov/dceo/Pages/EconPlan2019.aspx.

[6] State of Illinois Department of Commerce and Economic Opportunity. A Plan to Revitalize the Illinois Economy and Build the Workforce of the Future. October 2019. P. 50. Retrieved May 27, 2020, from illinois.gov/dceo/Pages/EconPlan2019.aspx.

[7] U.S. Department of Labor. CareerOneStop. 2020. Retrieved from careeronestop.org
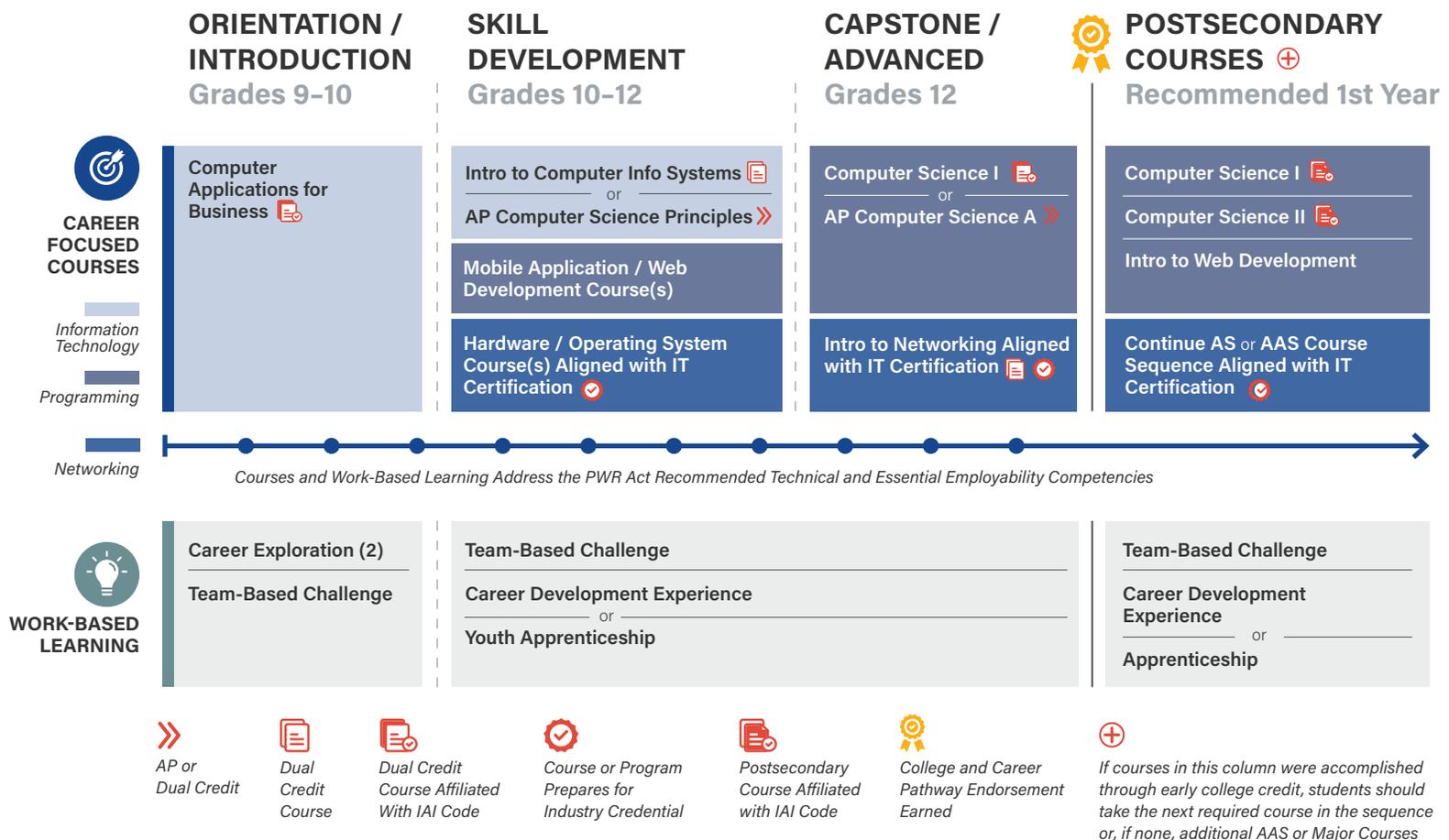
Programs of Study Description

The Model Programs of Study for Information Technology begin in high school by introducing students to the broad range of careers in the industry. Introductory and early college coursework combined with stackable credentials and work-based learning opportunities prepare students to demonstrate knowledge in fundamental IT areas like hardware, software, networking, and programming. At the postsecondary level, students are prepared to pursue promising credentials in one of the four areas of Computer Information Systems and Programming; Guided Transfer Computer Science; Web Development; and Networking, Cloud Computing, and Cybersecurity. In all four areas, students can or will soon be able to pursue the Model Program of Study sequence through the bachelor's level.

High School Career-Focused Instructional Sequence and Related Work-Based Learning
Overview
The high school career-focused instructional sequence in the IT Model Programs of Study builds from an Orientation/Introduction course in basic computer business applications towards a set of Skill Development

courses and Capstone/Advanced courses in Programming and Networking. Throughout, the sequence offers complementary courses and opportunities for all students, in particular for the ISBE CIP Codes of 11.0201, 11.0701, and 11.0901. It includes dual credit opportunities—such as Introduction to Computer Information Systems and the Illinois Articulation Initiative (IAI)-affiliated Computer Science I—alongside the Advanced Placement (AP) sequence of AP Computer Science Principles and AP Computer Science A[8]. These courses will prepare all students for continued IT coursework at the postsecondary level as well as provide foundational knowledge for pursuit of industry certifications. Students interested in Programming can start with introductory courses in mobile application or web development. Students interested in Networking can move from introductory courses in computer hardware and operating systems to a targeted introduction to networking, the dual-credit-aligned Introduction to Networking course. Introduction to Networking will prepare students to pursue an industry-recognized networking certification.

	ORIENTATION / INTRODUCTION Grades 9–10	SKILL DEVELOPMENT Grades 10–12	CAPSTONE / ADVANCED Grades 12	POSTSECONDARY COURSES ⊕ Recommended 1st Year
CAREER FOCUSED COURSES	Computer Applications for Business 🗒✓	Intro to Computer Info Systems 📄 or AP Computer Science Principles » Mobile Application / Web Development Course(s) Hardware / Operating System Course(s) Aligned with IT Certification ✓	Computer Science I 🗒✓ or AP Computer Science A » Intro to Networking Aligned with IT Certification 📄 ✓	Computer Science I 🗒✓ Computer Science II 🗒✓ Intro to Web Development Continue AS or AAS Course Sequence Aligned with IT Certification ✓

Information Technology
Programming
Networking

Courses and Work-Based Learning Address the PWR Act Recommended Technical and Essential Employability Competencies

| **WORK-BASED LEARNING** | Career Exploration (2)

Team-Based Challenge | Team-Based Challenge

Career Development Experience or Youth Apprenticeship | | Team-Based Challenge

Career Development Experience or Apprenticeship |

Legend:
- » AP or Dual Credit
- 📄 Dual Credit Course
- 🗒✓ Dual Credit Course Affiliated With IAI Code
- ✓ Course or Program Prepares for Industry Credential
- 🗒✓ Postsecondary Course Affiliated with IAI Code
- 🏅 College and Career Pathway Endorsement Earned
- ⊕ If courses in this column were accomplished through early college credit, students should take the next required course in the sequence or, if none, additional AAS or Major Courses

Ideally, students would start the career-focused instructional sequence with an Orientation/Introduction course in ninth grade. With an early start, students will have more openings in their schedule to complete Skill Development and Capstone/Advanced options across Programming and Networking, to obtain significant early college credits, and to earn valuable industry credentials all prior to high school graduation. As school districts and their community college partners develop the high school career-focused instructional sequence, they should ensure that the coursework enables all students to attain the State's recommended Technical Competencies for IT and Cross-Sector Essential Employability and Entrepreneurial Competencies (see Appendix A).

Orientation/Introduction

The Model Programs of Study for Information Technology commence at the Orientation/Introduction level with a suggested 9th or 10th grade course focused on computer applications and technology. The example shown in the Model Programs of Study map is the IAI-affiliated Computer Applications for Business. This course is designed for prospective business majors but applicable to all, aiming to train students in general software applications including word processing, spreadsheets, Internet access methods, and others[9]. These applications are foundational in professional work environments and serve as entry to the more technical coursework to follow. School districts can offer alternative Orientation/Introduction courses, such as the ISBE Computer Concepts and Software Applications, as well as seek out dual or articulated credit opportunities for students. All students should participate in multiple virtual and in-person engagements with employers to understand professional IT environments and engage with professionals in the field. Through an Orientation/Introduction course, students should be prepared to document their own personalized career pathway that leads to a promising credential defined in the Model.

Skill Development

The skill development course recommendations in the Model Programs of Study for Information Technology introduce 10th, 11th, or 12th grade students graders to introductory IT and computer hardware and software coursework. The recommended courses for all students include either the mapped Introduction to Computer Information Systems, which is intended to be offered as a dual credit course, or its typical AP equivalent, AP Computer Science Principles[10]. Additional recommended coursework at this stage consists of initial Programming course(s) in mobile application or web development—such

as ISBE's Web Page & Interactive Media Development courses—or initial Networking courses in computer hardware and software topics—such as ISBE's non-dual credit Computer Operations and Programming courses.

The Introduction to Computer Information Systems course provides students with technical introductions to IT topics ranging from Applications and Software to Hardware to Programming. Operating from a technical knowledge base across areas is critical for all students preparing for an IT career, both in the industry's current and future states. This course—a generic stand-in titled Fundamentals of Computer Information Systems, IT Fundamentals, or otherwise by various community colleges—will expand beyond the use of computer applications, as introduced in an Orientation/Introduction course, towards building students' understanding of the infrastructure underlying computer and information systems. The Postsecondary and Workforce Readiness (PWR) cross-disciplinary competencies such as problem solving, which is integral to programming and computer troubleshooting & support, will be woven throughout[11]. Proposed key course competencies are defined below in the Strategic Dual Credit Courses: Competency Statements section.

Introduction to Computer Information Systems is intended as a dual credit option equivalent to introductory computer information systems or technology coursework at the postsecondary level and to AP Computer Science Principles. Several community colleges around the state—including Harper College, Illinois Central College, Kishwaukee College, Rock Valley College—grant equivalent credit for Principles[12]. Either course serves as a prelude to Capstone/Advanced Programming coursework like the IAI-affiliated Computer Science I or AP Computer Science A.

At the Skill Development level, the IT Model Programs of Study also recommends students enroll in initial Programming- or Networking-focused courses. These courses would supplement the introduction to IT with opportunities to apply that knowledge towards specific IT focus areas, and, ideally, an industry-recognized credential like CompTIA A+[13]. Starting in tenth through possibly twelfth grades, all students would enroll in one of Introduction to Computer Information Systems or AP Computer Science Principles, and interested students would pursue concurrent or subsequent enrollment in Programming or Networking course(s). This combination would prepare students well for the Capstone/Advanced level.

Capstone/Advanced

At the Capstone/Advanced level, students can pursue advanced coursework in Programming, Networking, or both. The recommendation for students with a Programming focus is to enroll in either of the next-in-sequence early college credit courses: Computer Science I or AP Computer Science A. Students interested in Networking should enroll in the mapped Introduction to Networking, an intended dual credit course that introduces network concepts and provides a base of knowledge for future pursuit of relevant IT certifications.

In the Programming focus area, Computer Science I is an IAI-affiliated first course in a postsecondary computer science sequence. Students enrolling in this course should keep in mind the IAI's strong recommendation that they

enroll in both Computer Science I and the follow-up, Computer Science II, through the same postsecondary institution and that they focus on the same programming language in both courses[14]. The AP course equivalent, AP Computer Science A, builds on AP Computer Science Principles taken at the skill development level. Both recommended Programming courses expand on fundamental topics in computer science and programming and are considered equivalent in credit to an initial course for computer science majors[15].

The Networking focus area continues with the dual-credit Introduction to Networking, which provides students with a focused introduction to networking concepts across devices and media; software; models, layers, and

	ORIENTATION / INTRODUCTION Grades 9–10	SKILL DEVELOPMENT Grades 10–12	CAPSTONE / ADVANCED Grades 12	POSTSECONDARY COURSES ⊕ Recommended 1st Year
WORK-BASED LEARNING	Career Exploration (2) / Team-Based Challenge	Team-Based Challenge / Career Development Experience — or — Youth Apprenticeship		Team-Based Challenge / Career Development Experience — or — Apprenticeship
SCIENCE	Science Sequence	Science Sequence	Science ≫	Science 📑✓
SOCIAL SCIENCE	Social Science Sequence	Social Science Sequence	Social Science ≫	Social Science 📑✓
MATH	Algebra / Geometry	Geometry / Algebra 2 / Pre-Calculus	Transitional Math: STEM / College Algebra 📄 / Pre-Calculus / Calculus ≫ 📑✓ / Statistics ≫ 📑✓	College Algebra / Calculus 📑✓ / Statistics 📑✓
ENGLISH	English Sequence	English Sequence	Transitional English / English Composition ≫	English Composition 📑✓ / Oral Communication 📑✓

≫ AP or Dual Credit

📄 Dual Credit Course

📑✓ Dual Credit Course Affiliated With IAI Code

✓ Course or Program Prepares for Industry Credential

📑✓ Postsecondary Course Affiliated with IAI Code

🎖 College and Career Pathway Endorsement Earned

⊕ If courses in this column were accomplished through early college credit, students should take the next required course in the sequence or, if none, additional AAS or Major Courses

protocols; privacy, security, and ethics; virtualization and cloud computing; and others. Whereas Skills Development courses touch on networking—a topic relevant for all IT students—this course builds the broad conceptual knowledge necessary to ultimately earn industry-recognized networking certifications like CompTIA's Network+ or Cisco's CCNA[16]. Following the course, students should be prepared to take a certification exam in networking, and advanced students could be positioned for more intermediate or cloud-focused certifications. Earning these or other credentials would serve as signals of job-ready skills that complement knowledge built in students' other coursework. Proposed course competencies for Introduction to Networking are defined in Section IV.

All students should continue participation in IT-related clubs or challenges and complete a Career Development Experience (CDE) of at least 60 hours in length. As their schedules permit, students are highly encouraged to enroll in Capstone/Advanced coursework in both Programming and Networking.

Recommended High School General Education Courses

The IT Model Program of Study identifies several key considerations for general education coursework:

- In **science** and **social science**, students should complete upper-level courses as either AP or dual credit affiliated with an IAI course code if possible.

- In **math**, students should culminate their current course sequence, as appropriate, with one of the following: a Transition to STEM Transitional Math course that will guarantee placement into postsecondary College Algebra; a dual credit College Algebra course; Pre-Calculus; one or both courses in the AP Calculus sequence; and/or AP Statistics. Establishing a sound foundation in math and statistics helps ensure that students are prepared for the full extent of professional opportunities in IT.

- In **English**, students prepared for college-level coursework in their senior year should enroll in a dual credit English Composition course (if available). Students who are not prepared for college-level coursework should enroll in a Transitional English course that guarantees placement into the partner community college's English Composition course.

Recommended First Year Postsecondary Courses
The recommended first-year postsecondary courses in

the IT Model Program of Study extend the knowledge and skills recommended at the Capstone/Advanced level. Branching from the secondary Programming focus area, in the career focused courses, the IAI-affiliated Computer Science I and Computer Science II courses prepare students for guided transfer from community college to a Computer Science baccalaureate program. An Introduction to Web Development course, also branching from secondary Programming, serves as students' entry to Web Development at the postsecondary level. Students interested in pursuing the Computer Information Systems and Programming or Networking, Cloud Computing, and Cybersecurity focus areas—the latter serving as an extension of the secondary Networking—are recommended to pursue an AS or AAS course sequence, as appropriate, with supplementary coursework aligned to a relevant IT certification(s). All the focus areas either currently or will soon offer baccalaureate opportunities.

The general education course areas focus on 100- and 200-level required coursework. In math, students are recommended to enroll in the most appropriate course, per placement or ultimate focus area of interest, of College Algebra, Calculus, or Statistics. Across general education areas, if the introductory courses have been accomplished through early college credit, students will take the next required course in the subject or, if none are still required, additional AAS or major courses.

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Strategic Dual Credit Courses: Competency Statements

As mentioned, EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the Model Programs of Study recommendations. A smaller working group further convened to identify key competencies for the target early college courses in the Model Programs of Study currently lacking current statewide articulation. In IT, those courses were Introduction to Computer Information Systems and Introduction to Networking.

Course Descriptions

Introduction to Computer Information Systems

This course introduces students to a range of topics and concepts related to computer information systems. Students will build understanding of information technology and systems, applications and software, data and file structures, hardware, networking and cloud computing, security, and programming. They will identify and discuss current and emerging issues related to privacy and ethics in information technology. And they will apply communication and problem-solving skills towards addressing IT business problems.

Introduction to Networking

This course introduces students to a range of topics and concepts related to computer networking. Students will build understanding of network devices and media, software, models and protocols, types and topologies, security, and virtualization and cloud computing. They will identify and discuss current and emerging issues related to privacy and ethics in information technology and networking. And they will apply communication and problem-solving skills towards addressing common network issues encountered by users.

INTRODUCTION TO COMPUTER INFORMATION SYSTEMS
Key Competencies

Applications and Software	• Students can use their understanding of system software and software applications to explain the purposes and functions of operating systems, essential system utilities, general business software applications, and mobile and web-based applications. • Students can use their understanding of general software development to describe the life cycle of a software product from gathering requirements through deployment, maintenance, and next iteration.
Data and File Structures	• Students can use their understanding of common data and file structures to move, store, reference, access, and manipulate data or files necessary to create information.
Hardware	• Students can use their understanding of computer and peripheral hardware to explain the purposes and functions of the system unit and its components, input and output devices, and physical and virtual network devices and media.
Information Technology and Systems	• "Students can use their understanding of fundamental IT concepts, systems, platforms, tools, and technology to understand the common roles of IT professionals." – PWR • Students can use their understanding of information systems to explain the purposes and functions of transactional, management, decision support, and other system types relevant to information technology.
Networking and Cloud Computing	• Students will use electronic resources and research methods to read medical writings and understand the medical information contained in them. • Students will analyze and interpret patient records, lab reports, diagnostic summaries, etc., and the information contained in them.
Privacy, Security, and Ethics	• Students can use their understanding of fundamental privacy to identify and describe common and emerging privacy issues relevant to information technology and data. • Students can use their understanding of physical and virtual security controls to identify, describe, mitigate, and prevent basic threats to computers and data. • Students can use their understanding of fundamental ethics to identify and describe common and emerging ethical issues relevant to information technology, data, and artificial intelligence.
Programming	• Students can use their understanding of programming to code and debug basic programs via a graphical user interface and a command line interface.
Problem Solving and User Support	• Students can use their understanding of information technology and basic problem solving to identify a business problem; determine the problem's cause(s); and create, communicate, implement, and document a plan to resolve the problem. • Students can use their understanding of computers and communications to assist and support computer users in addressing common hardware and software issues.

INTRODUCTION TO NETWORKING
Key Competencies

Devices and Media	• Students can use their understanding of networking infrastructure to explain the purposes, functions, and appropriate deployment of various network devices, media, and technology.
Software	• Students can use their understanding of system software and software applications to explain the purposes and functions of a network operating system and common network utilities.
Models and Protocols	• Students can use their understanding of the Open Systems Interconnect (OSI) model to identify and differentiate between OSI layers and their respective devices, protocols, and other components. • Students can use their understanding of TCP/IP to subnet and address an IP network. • Students can use their understanding of networking protocols to explain the purposes and functions of common ports.
Types and Topologies	• Students can use their understanding of LAN and WAN to configure and monitor basic networks of each type. • Students can use their understanding of physical and logical network topology to compare, contrast, and deploy bus, mesh, ring, and star topologies.
Security	• "Students can use their understanding of malware, firewall, IDS, and IPS to recognize and describe basic threats to networked computers." – PWR • Students can use their understanding of physical and virtual security controls to secure basic local and wireless networks.
Privacy and Ethics	• Students can use their understanding of fundamental privacy to identify and describe common and emerging privacy issues relevant to information technology and data. • Students can use their understanding of fundamental ethics to identify and describe common and emerging ethical issues relevant to information technology and data.
Troubleshooting and Support	• Students can use their understanding of troubleshooting to identify common network issues; determine an issue's cause(s); and create, communicate, implement, and document a plan to resolve the issue. • Students can use their understanding of networking and communications to assist and support network users in addressing common network issues.
Virtualization and Cloud Computing	• Students can use their understanding of networking and the Internet to describe the concepts of virtualization and cloud computing. • "Students can use their understanding of the features, benefits, and concepts of virtualization and cloud networking to differentiate among types of cloud services." – PWR

APPENDIX A.1: PWR Act Recommended Technical Competencies for Information Technology

INFORMATION TECHNOLOGY

TOP 10 TECHNICAL COMPETENCY STATEMENTS FOR INFORMATION TECHNOLOGY

Basic Principles of Information Technology Concepts, Systems, Platforms & Tools	Students can use their understanding of fundamental IT concepts, systems, platforms, tools, and technology to understand the common roles of IT professionals.
Security	Students can use their understanding of malware, firewall, IDS, and IPS to recognize and describe basic threats to networked computers.
Logic & Fundamentals of Computer Languages	Students can use their understanding of how computer languages communicate to build basic mobile and web applications.
Routing & Network Configuration	Students can use their understanding of common networking protocols to explain the purpose of routing, network configuration, and monitoring.
User & Customer Support	Students can use their understanding of the range of services used to provide assistance and technical support to help users implement and solve problems related to information technology.
Basic Principles of Hardware	Students can use their understanding of communication systems hardware to describe the purpose and function of fundamental end user devices, switches, routers, wireless access points, etc.
Risk Management & Information Assurance	Students can use their understanding of the standards and applications needed to protect the confidentiality, integrity, and availability of information and information systems.
Basic Principles of Software Development	Students can use their understanding of designing, writing, testing, and maintaining source code of computer programs to manage and maintain software.
Networks	Students can use their understanding of hardware and software to facilitate communication between people and computer systems.
Basics of Virtualization & Cloud Computing	Students can use their understanding of the features, benefits, and concepts of virtualization and cloud computing to differentiate among types of cloud services.

APPENDIX A.2: PWR Act Essential Employability Competencies

TOP 10 CROSS-SECTOR ESSENTIAL EMPLOYABILITY COMPETENCY STATEMENTS	
Teamwork & Conflict Resolution	Students can use their understanding of working cooperatively with others to complete work assignments and achieve mutual goals.
Communication	**Verbal:** Students can use their understanding of English grammar and public speaking, listening, and responding, convey an idea, express information, and be understood by others. **Written:** Students can use their understanding of standard business English to ensure that written work is clear, direct, courteous, and grammatically correct. **Digital:** Students can use their understanding of email, keyboarding, word processing, and digital media to convey work that is clear, direct, courteous, and grammatically correct.
Problem Solving	Students can use their critical thinking skills to generate and evaluate solutions as they relate to the needs of the team, customer, and company.
Decision Making	Students can use their understanding of problem solving to implement and communicate solutions.
Critical Thinking	Students can use their understanding of logic and reasoning to analyze and address problems.
Adaptability & Flexibility	Students can use their understanding of workplace change and variety to be open to new ideas and handle ambiguity.
Initiative & Self-Drive	Students can use their understanding of goal setting and personal impact to achieve professional goals and understand personal impact.
Reliability & Accountability	Students can use their understanding of commitment, time management, and follow through to ensure that a professional team functions properly and meets collective goals.
Cultural Competence	Students can use their understanding of diversity and inclusion to communicate and work effectively across a multitude of abilities, cultures, and backgrounds.
Planning & Organizing	Students can use their understanding of time management to plan effectively and accomplish assigned tasks.

APPENDIX B: Advisory Committee Membership

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