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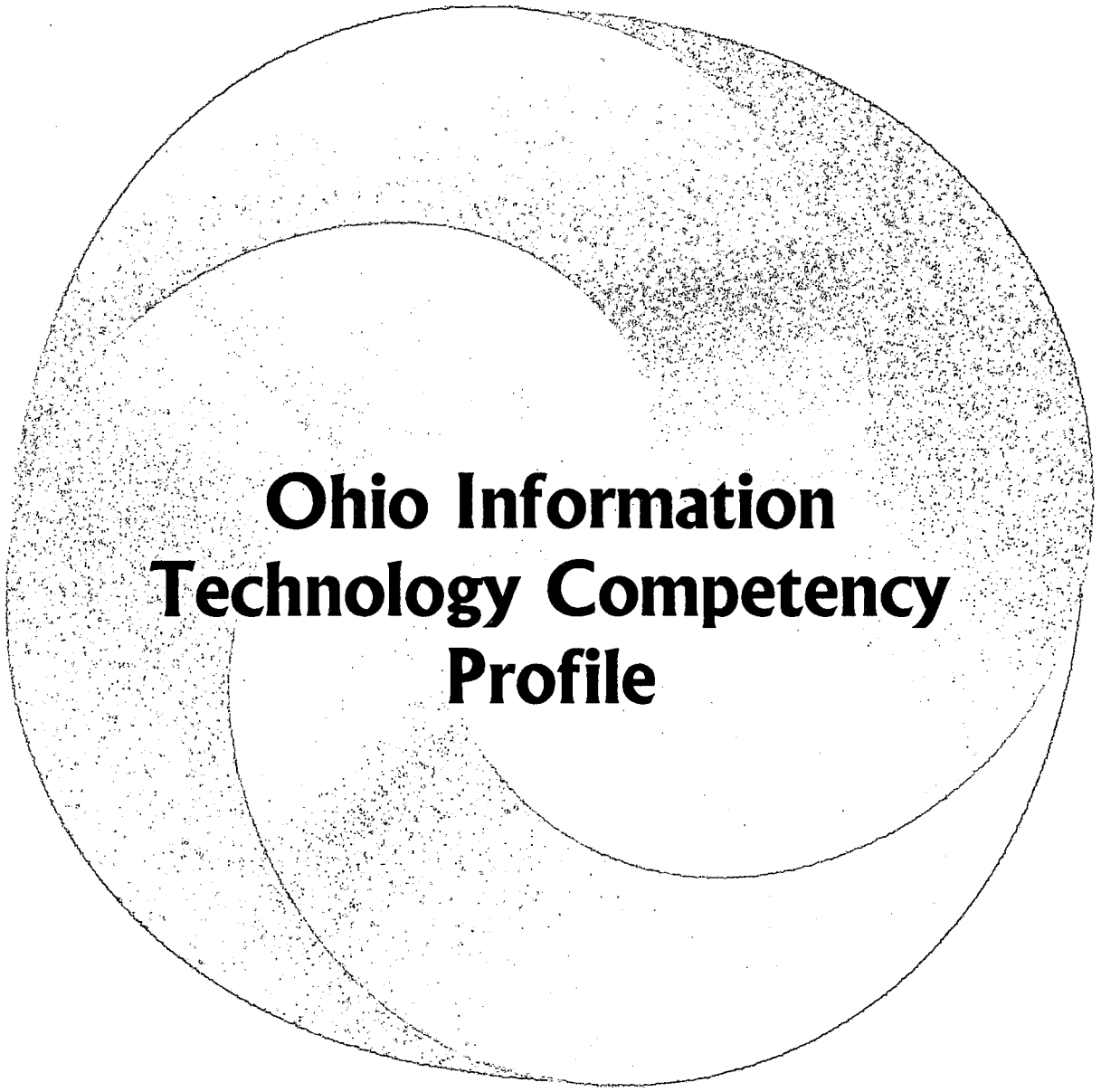
ABSTRACT

This profile includes a comprehensive set of information technology competencies that are grounded in core academic subject areas and built around four occupational clusters (information services and support, network systems, programming and software development, and interactive media) that reflect the job opportunities and skills required for Ohio's information technology workers. The main part of the document is made up of 49 units that contain competencies and competency builders for the following knowledge and skills areas: information technology basics; computer applications; data communications; programming theory; applied programming languages; computer user support; software development; software systems management; appreciation of the arts; graphic design fundamentals; photography; digital media design; video and film production; audio production; the Internet; Web page design; interactive multimedia production; hardware design, operation, and maintenance; operating systems; networking; network architectures; network operating systems; wide-area networks; network management; basic mainframe concepts; database management system basics; database administration; data warehousing; application development life cycle; information systems theory; information systems management; information system analysis and design; system installation and maintenance; system administration and control; project management; communication; technical writing and documentation; customer relations; economic and business concepts; financial management functions; international business; management and supervision; business law, ethics, and legal issues; quality assurance; training products; statistics; basic electricity; fundamentals of electronics technology; and telecommunications. Two appendixes contain summaries of academic connections of the Ohio Model Competency-Based Programs in Language Arts, Mathematics, and Science, and a certification crosswalk summary. (KC)

Information Technology for Ohio's New Economy

itWORKS.OHIO





# Ohio Information Technology Competency Profile



**Ohio Department of Education**
**Ohio Board of Regents**

**www.itworks-ohio.org**

# INTRODUCTION

The Ohio Information Technology Competency Profile was developed under the auspices of the Joint Council of the Ohio Board of Regents and the State Board of Education. It provides the framework for *it*WORKS.OHIO, a broad-based educational response to Ohio's need for a skilled information technology (IT) workforce.

The profile includes a comprehensive set of information technology competencies that are grounded in core academic subject areas and built around four occupational clusters: Information Services and Support, Network Systems, Programming and Software Development, and Interactive Media. Generated using the Ohio Tech Prep model of curriculum development, the profile reflects the job opportunities and skills required for Ohio's information technology workers.

Formed in 1998, the Ohio Information Technology Task Force was instrumental in creating an action plan to develop these skill standards. Representatives from a broad cross-section of Ohio businesses and industries played a critical role in this effort by defining the vision and scope of information technology, and by identifying the essential and recommended skills for current and future information technology professionals. Secondary and post-secondary educators representing schools and colleges throughout Ohio identified when in the educational process and to what depth those skills identified by business should be addressed. Using Ohio's Model Competency-Based Program in Mathematics, Science, and Language Arts, critical academic skills needed to support technical skills were identified. Business/industry and educational representatives conducted a crosswalk between the profile and a number of business-generated certificate programs to facilitate IT program administration. (A list of business/industry representatives and educators participating in the development of the profile appears on the following pages.)

As part of the *it*WORKS.OHIO initiative, the Ohio Information Technology Profile will be used as the basis for the development of an integrated delivery system that provides opportunities for new and challenging information technology programs and courses in Ohio's secondary schools, colleges, and universities. Career-Technical Education, Tech Prep, and adult education will be enhanced and expanded through the use of the IT curriculum.

This profile is available on the Internet at: **www.itworks-ohio.org** At this location, users can download copies of the entire profile or conduct searches on a number of key variables. Additional information on academic connections and certification crosswalks is available at this site.

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# ACKNOWLEDGEMENTS

The Ohio Information Technology Competency Profile is a project of the Joint Council of the Ohio Board of Regents and the State Board of Education. In addition to the business/industry representatives and secondary and post-secondary educators listed on pages vii-xix, a number of individuals contributed their time and expertise to this initiative. Special thanks is due to Garry Walters, Vice-Chancellor, Ohio Board of Regents; Jonathan L. Tafel, Associate Vice-Chancellor, Ohio Board of Regents; and Joanna Kister, Director, Career-Technical and Adult Education, Ohio Department of Education. Their vision, support, and encouragement made this project possible.

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# TABLE OF CONTENTS

# PANEL PARTICIPANTS

# INFORMATION TECHNOLOGY PROFILE REVIEW PANELS

## FUTURING PANEL
October 14, 1998

**Purpose:** To define vision and scope of information technology and identify critical occupational areas

**Participants:**

**Delden Fane**, President/CEO
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**Lisa Finneran**, Client Services Manager, Professional Services
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**Ken Kerr**, President
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**Dave Krieger**
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American Greetings Corp.

**Bob Olds**, Vice President-Provisioning
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**Ray Zink**, Marketing Manager
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## BUSINESS/INDUSTRY/LABOR REVIEW PANEL

January 6, 1999

| | |
|---|---|
| **Purpose:** | To identify essential and recommended skills for information technology professionals |
| **Information Services and Support:** | **Dan Brunbaugh**, President<br>Counterpoint Technologies |
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**Angela Walters**, President
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**Sue Flore**, Regional Manager, Sales
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**Dale Johnson**, President
AD/link

**Sandy LaCorte**, President
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**Jim Morrison**, Director, Multimedia Productions
American Greetings Corp.

**Rob Pettit**, Senior Strategist, New Media & Internet Solutions
Mills/James Productions

**John Simpkins**, Project Manager
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**David Watkins**, President
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## TECHNICAL EDUCATOR REVIEW PANEL

January 27, 1999

**Purpose:** To identify when and to what depth essential and recommended information technology skills should be addressed

**Information Services and Support:**

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Withrow High School, Raymond Walters College

**Linda Back**, Teacher, Business Education
Grant Career Center

**Dean Gibney**, Instructor, Computer Support Tech
Greene County Career Center

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Ohio SchoolNet

**Judy Kirkbride**, Vocational/Business Teacher
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**Richard D. Taylor**, Business Department Coordinator, Business Education, Mentor High School

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**Tom Newman**, Computer/Networking Instructor, Electronics T/T
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**Ashraf Saad**, Assistant Professor, Information Engineering Technology, College of Applied Science, University of Cincinnati

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**Barbara Sherman**, Teacher, Computer Education
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**Robin Thompson**
Belmont High School

**John Umstead**, Teacher, Business Education
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**Mike Wilson**, Instructor, Electronics
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**Programming & Software Development:**

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Bowling Green State University - Firelands College

**Bill Pfabe**, Teacher, Business Education
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**Patricia Santoianni**, Professor, CIS
Sinclair Community College

**Denise Shaneyfelt**, Business Instructor, Business Education
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**M. Frances Stuck**, Teacher, Business Education
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**Interactive Media:**

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Auburn Career Center

**Jeannette Brown**, Coordinator, COST
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Lakeland Community College

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Rocky River Schools

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**Melissa Rock**, Instructor, "Digital Design" Commercial Arts
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Mariemont City School District

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February 23, 1999

| | |
|---|---|
| **Purpose:** | To identify critical academic skills needed to perform information technology-related skills |
| **Communications/ Language Arts:** | **Craig Butz**, English Teacher<br>Tri-County Vocational School |
| | **Pamela Ecker**, Program Chair, Technical Writing, Humanities<br>Cincinnati State Technical & Community College |
| | **Doug Fay**, English Teacher<br>Northwest High School |
| | **Bill Hope**, Program Director, Humanities<br>Jefferson Community College |
| | **Rachael Lang**, English/Applied Communications Instructor<br>Ohio High Point Career Center |
| | **Rosann Lauri**, Language Arts Teacher<br>Edison High School |
| | **Darren McGarvey**, English Teacher, English/Speech<br>Kettering Fairmont High School |
| | **Cathy Miles**, Language Arts Teacher<br>Edison High School |
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| **Science:** | **Richard Drewes**, Science/Math Teacher<br>Northwest High School |
| | **Quentin Heaton**, Science Teacher<br>Steubenville High School |
| | **Holli Jacobs**, Science Teacher<br>Clay High School |
| | **Edward K. Moeller**, Math/Science Instructor<br>Buckeye Career Center |
| | **Sue Vallera**, Assistant Professor, Engineering Applied & Computer Sciences, Jefferson Community College |
| **Mathematics:** | **Catherine Armetta**, Math Teacher<br>Auburn Career Center |
| | **Roxane Barrows**, English/Math Instructor<br>Hocking College |

**Hal Berg**, Math Teacher
Patterson Career Center

**Lauri Beyer**, Math Teacher
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**Paul Filtz**, Math Teacher
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**Subject Matter Experts:**

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**Gail Elton**, Computer & Business Technology Teacher
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Redicon Corporation

## STAKEHOLDER PANEL

March 16, 1999

| | |
|---|---|
| **Purpose:** | To refine Ohio Information Technology Competency Profile through dialogue among all stakeholders |
| **Information Services and Support:** | **Linda Back**, Computerized Business Technology Instructor<br>Grant Career Center |
| | **John Davalos**, NT Enterprise Manager<br>Lexis-Nexis |
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| | **Dean Gibney**, Instructor, Computer Support Tech<br>Greene County Career Center |
| | **Joyce Hicks**, Project Manager<br>TRW Systems & Information Technology Group |
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| | **Marcia Miller**, Business Teacher<br>Elyria High School |
| | **Michael Nakoff**, Associate Department Chair, Business Computer Science, Cincinnati State Technical & Community College |
| | **Richard D. Taylor**, Business Department Coordinator, Business Education, Mentor High School |
| **Networking Systems:** | **Jim Kouri**, Manager, Communications Services<br>Honda of America Manufacturing |
| | **Mike Laird**, Instructor, Tech Prep<br>Tri-Rivers Career Center |
| | **Ashraf Saad**, Assistant Professor, Info. Engineering Technology<br>University of Cincinnati |
| | **Ken Schneider**, Manager, IT Support Services<br>Nordson Corporation |
| | **Maria Schoonover**, Director, Telecommunications<br>Lexis-Nexis |
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| | **John Umstead**, Teacher, Business Education<br>Fairfield Career Center |

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**Programming & Software Development:**

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**Barbarita Barton**, Teacher, Building Technology Coordinator
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**Bill Pfabe**, Teacher, Business Education
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**Ronald Miller**, Technology Coordinator
Rocky River Schools

**Jill Morris**, Business Instructor
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| | **Keith Stephens**, Math Teacher, Computer Networking<br>Clay High School |

## VENDOR CERTIFICATION REVIEW PANEL

May 12, 1999

| | |
|---|---|
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| | **Ashraf Saad**<br>University of Cincinnati, Cincinnati, OH |
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| **Novell:** | **Gene Andres**<br>Lakeland Community College, Kirkland, OH |
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TERC, Cambridge, MA

# PROFILE DEFINITIONS AND CODES

# OCCUPATIONAL AREA DEFINITIONS

## INFORMATION SERVICES AND SUPPORT (ISS)

The Information Services and Support program area will prepare students for careers dealing with information technology deployment. Students will gain the necessary skills to implement computer systems and software, provide technical assistance, and manage information systems. Skills needed to acquire certifications will be an integral part of this program. Essential skill areas include but are not limited to:

General Computer Usage Skills
Management Information Systems
Overall Use of Network System
Basic Programming
Basic Software Development
Basic Interactive Multimedia Development
Business Skills
Management Skills

**Sample list of job titles:**

Computer Operator
IS Operator/Analyst
Computer Operations Technician
Operations Scheduler
Data Analyst
Database Analyst
Database Developer
Database Specialist
Database Administrator
Customer Service Representative
Technical Support Engineer
Product Support Engineer
Call Center Support Representative
Help Desk Technician
Technical Support Representative
Technical Sales Consultant
PC Support Specialist
PC System Coordinator
PC Technician
Technical WriterSoftware Application Specialist
LAN Applications Support Analyst
Lead Customer Service Coordinator
Systems Administrator

## NETWORK SYSTEMS (NS)

The Network Systems program area will prepare students for careers dealing with network systems analysis, planning and implementation. Students will gain the necessary skills to analyze network system needs for design, installation, maintenance and management of network systems. Skills acquired will assist students to obtain network certifications. Essential skill areas include but are not limited to:

Operations
Network Administration
Basic Network Design Theory
Network Troubleshooting
Network Security
Network Operations Center
Computer Hardware Maintenance
Network Management

**Sample list of job titles:**

Network Specialist
Network Operations Analyst
Communications Analyst
Network Analyst
Cable Installers
Local Area Network Technician
Network Administration
Network Maintenance and Operations
Hardware Support/Maintenance
Network Administrator
Telecommunications Technician
Wide Area Network Technician
Customer Service Coordinator
Hardware Installations Coordinator
Network Technician

## PROGRAMMING AND SOFTWARE DEVELOPMENT (PSD)

Students training in the areas of hardware and software programming and analysis will learn to design, develop, test, document, implement and maintain computer systems and software. Students will select from program specialties that will lead to computer training in computer operating systems, programming languages, software development, application and computer maintenance. Essential skill areas include but are not limited to:

Computer System Architecture
Programming Analysis
Software Design
Application/Operating System Programming
GUI/Interface
WEB Design Utilization
Computer Application Development and Implementation

**Sample list of job titles:**

Systems Analyst
Programmer Analyst
Operating Systems Specialist
Software Designer
Software Applications Specialist
Test Specialist
Software/Application Support
Database Software Technician
Entry (Junior Level) Programmer
Senior Level Programmer

## INTERACTIVE MEDIA (IM)

Students training in the area of interactive multi-media will become competent in creating, designing, and producing interactive multi-media products and services. This program of study emphasizes the development of digitally-generated or computer-enhanced media. Students will use multi-media technology to develop products/programs for business, training, entertainment, communications and marketing. Essential skill areas include but are not limited to:

Animation
Media Design
Interactive Digital Media
GUI Interfaces
Instructional Application
Application Design
Authoring Languages
Audio/Visual Production
Digital Imaging

**Sample list of job titles:**

Animator
Imaging Specialist
Audio/Visual Specialist
Media Designer
Multi-Media Specialist
Production Assistant
Interactive Digital Media Specialist
Virtual Reality Designer
Web Designer
Graphic Designer
Multi-Media Programmer
Graphics Technician
Visual Design Consultant
Web Content Designer
Instructional Designer
Writer
Project Manager
Multimedia Technician
Quality Assurance Technician

# KEY TO PROFILE CODES

**Determined by Business, Industry and Labor Review Panel (BIL)**

**OCCUPATIONAL AREAS:**

ISS = Information Services and Support
NS = Network Systems
PSD = Programming and Software Development
IM = Interactive Media

**ESSENTIAL COMPETENCY:**

E = Competency is needed to ensure minimal level of employability. Entry level employees should be able to perform this competency without supervision.

**RECOMMENDED COMPETENCY:**

R = Competency should be included but is not essential for minimal level of employability.

**Determined by Technical Educator Review Panel (EDU)**

**GRADE LEVEL:**

10 = by the end of grade 10
12 = by the end of grade 12
AD = by the end of the Associate Degree

**DEPTH:**

I = Introduce Competency (competency builders to be introduced prior to the end of the 12th grade for all essential competencies are indicated by the presence of an occupational area code following a competency builder.)
IR = Reinforce or add depth after introducing a competency.
P = Proficient or achievement of the competency without supervision.
PR = Reinforce or add depth after proficiency.

**Determined by Academic Educator Review Panel (AC)**

**ACADEMIC CONNECTIONS:**

AC = Academic Connections identified with the Ohio Competency-Based Program in Language Arts, Mathematics, and Science.

**Determined by Vendor Certification Review Panel**

**CERTIFICATE CONNECTIONS:**

RC = Relevant Certification: a listing of certificate programs which address a specific competency.
Note: Certificate codes in **boldface** type indicate that competency is only partially addressed by this certificate.

**CERTIFICATE CODES:**

| | |
|---|---|
| A+ = | A+ Certification |
| CCNA = | Cisco Certified Network Associate |
| CCNA-Curr = | Cisco Certified Network Associate - Compared Curriculum |
| MOUS = | Microsoft Office User Specialist |
| MCP = | Microsoft Certified Professional |
| MCSE = | Microsoft Certified Systems Engineer |
| MCSD = | Microsoft Certified Solutions Developer |
| MCDBA = | Microsoft Certified DataBase Administrator |
| CNA = | Novell Certified Network Administrator |
| CNE = | Novell Certified Network Engineer |
| NKC = | Nortel NetKnowledge Certification |

# COMPETENCY PROFILE

# OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE MATRIX

ISS = Information Services and Support PSD = Programming and Software Development
NS = Network Systems IM = Interactive Media

| Page | Unit | UNIT | ISS | NS | PSD | IM |
|---|---|---|---|---|---|---|
| 1 | 1 | Information Technology Basics | E | E | E | E |
| 5 | 2 | Computer Applications | E | E | E | E |
| 10 | 3 | Data Communications | E | E | E | E |
| 12 | 4 | Programming Theory | E | | E | |
| 14 | 5 | Applied Programming Language | E | | E | |
| 16 | 6 | Computer User Support | E | E | E | |
| 18 | 7 | Software Development | R | | E | |
| 27 | 8 | Software Systems Management | E | E | E | R |
| 30 | 9 | Appreciation of the Arts | | | | R |
| 32 | 10 | Graphic Design Fundamentals | | | | E |
| 36 | 11 | Photography | | | | R |
| 37 | 12 | Digital Media Design | | | | E |
| 43 | 13 | Video/Film Production | | | | E |
| 48 | 14 | Audio Production | | | | E |
| 50 | 15 | Internet | E | E | E | E |
| 53 | 16 | Web Page Design | E | R | E | E |
| 58 | 17 | Interactive Multimedia Production | | | | E |
| 63 | 18 | Hardware Design, Operation, and Maintenance | E | E | E | R |
| 71 | 19 | Operating Systems | E | E | E | |
| 77 | 20 | Networking | E | E | | |
| 83 | 21 | Network Architectures | E | E | R | |
| 87 | 22 | Network Operating Systems | E | E | E | |
| 89 | 23 | Wide-Area Networks | E | E | R | R |
| 91 | 24 | Network Management | E | E | | |
| 100 | 25 | Basic Mainframe Concepts | R | | E | |
| 103 | 26 | Database Management System Basics | E | | E | E |
| 107 | 27 | Database Administration | E | | E | |
| 113 | 28 | Data Warehousing | E | | E | |
| 116 | 29 | Application Development Life Cycle | E | | E | |
| 121 | 30 | Information Systems (IS) Theory | E | E | R | |
| 125 | 31 | Information Systems Management | R | E | | |
| 128 | 32 | Information System Analysis and Design | E | R | R | |
| 132 | 33 | System Installation and Maintenance | E | E | R | |
| 137 | 34 | System Administration and Control | E | E | | |
| 140 | 35 | Project Management | E | E | R | R |
| 143 | 36 | Communication | E | E | E | E |
| 146 | 37 | Technical Writing and Documentation | E | E | E | E |
| 150 | 38 | Customer Relations | E | E | E | E |
| 152 | 39 | Economic and Business Concepts | E | E | E | E |
| 155 | 40 | Financial Management Functions | E | R | E | E |
| 158 | 41 | International Business | E | E | E | E |
| 160 | 42 | Management and Supervision | E | E | E | |
| 167 | 43 | Business Law, Ethics and Legal Issues | E | E | E | E |
| 171 | 44 | Quality Assurance | E | R | E | E |
| 175 | 45 | Training Products | | | | R |
| 176 | 46 | Statistics | R | R | R | |
| 180 | 47 | Basic Electricity | R | R | | |
| 184 | 48 | Fundamentals of Electronics Technology | E | R | | |
| 189 | 49 | Telecommunications | E | E | | |

**E** = Essential **R** = Recommended

# Unit 1: Information Technology Basics

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science, Communications
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
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**Competency 1.1: Demonstrate basic knowledge of the history of information technology**

*Competency Builders:*

1.1.1 Demonstrate knowledge of significant advances in the development of computer hardware and software

1.1.2 Demonstrate knowledge of major milestones in the development of information technology

1.1.3 Demonstrate knowledge of major individuals and their contributions to the information technology field

1.1.4 Demonstrate knowledge of the speed with which computer technology has evolved (i.e., evolution time line)

1.1.5 Demonstrate knowledge of the role of data transmission in media, signaling techniques, transmission, and impairments

**BIL:** Essential – NS, PSD, IM Recommended – ISS
**AC:** Science
**RC:** CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | I | IR | P |
| PSD | | I | P |
| IM | I | P | |

**Competency 1.2: Demonstrate knowledge of the impact of information technology on society**

*Competency Builders:*

1.2.1 Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions (NS, PSD)

1.2.2 Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs) (NS, PSD)

1.2.3 Demonstrate knowledge of the psychological and health risks associated with computers (NS, PSD)

1.2.4 Demonstrate knowledge of security risks and associated safeguards (NS, PSD)
1.2.5 Demonstrate knowledge of the possible effects of natural disasters on computers (NS, PSD)
1.2.6 Demonstrate knowledge of international telecommunications standards and trends (NS, PSD)
1.2.7 Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide (NS, PSD)
1.2.8 Identify issues and trends affecting computers and information privacy (NS, PSD)
1.2.9 Demonstrate knowledge of ethical issues that have surfaced in the information age (NS, PSD)
1.2.10 Demonstrate knowledge of how information technology affects the natural environment (e.g., disposal of equipment, energy use, use of natural resources) (NS, PSD)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| NS | | P | |
| PSD | | P | |
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**Competency 1.3: Demonstrate knowledge of the hardware components associated with information systems**

*Competency Builders:*

1.3.1 Identify the three main classifications of computers (i.e., micro-, mid-range, and mainframes)
1.3.2 Identify the elements of the information processing cycle (i.e., input, process, output, and storage)
1.3.3 Identify major hardware components and their functions
1.3.4 Identify types of computer storage devices
1.3.5 Identify types of processing (e.g., batch, interactive, event-driven, object-oriented)
1.3.6 Identify major operating system fundamentals and components
1.3.7 Identify the role the binary system in information systems
1.3.8 Demonstrate knowledge of number systems and internal data representation
1.3.9 Identify the hardware associated with telecommunications functions
1.3.10 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
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**Competency 1.4: Demonstrate knowledge of the classes of software associated with information systems**

*Competency Builders:*

1.4.1 Demonstrate knowledge of the key functions of systems software
1.4.2 Demonstrate knowledge of widely used software applications (e.g., word processing, database management, spreadsheet development)
1.4.3 Demonstrate knowledge of the range of languages used in software development
1.4.4 Demonstrate knowledge of how data is organized in software development
1.4.5 Identify new and emerging classes of software

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science
**RC:** CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | I | P | |
| NS | I | P | |
| PSD | I | P | |
| IM | I | P | |

**Competency 1.5: Identify career opportunities in information systems**

*Competency Builders:*

1.5.1 Identify entry-level positions
1.5.2 Identify possible career pathways
1.5.3 Identify types of programmer/analyst positions available and the nature of each
1.5.4 Identify types of administration/management positions available and the nature of each
1.5.5 Identify present and future employment opportunities (by geographic location)
1.5.6 Research job opportunities
1.5.7 Compare salary ranges and benefit packages
1.5.8 Compile occupational profile
1.5.9 Identify certification issues within a particular career path
1.5.10 Identify education and training requirements for selected career pathway
1.5.11 Design a career ladder for own career in information technology (i.e., personal goal-setting)
1.5.12 Design a time line for own career advancement in the information technology field

1.5.13 Identify professional organizations in the area of information technology
1.5.14 Identify benefits derived from membership in specific professional organizations

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | I | P | |
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**Competency 1.6: Explore the future of information technologies**

*Competency Builders:*

1.6.1 Identify new technologies relevant to information technology
1.6.2 Measure increases in productivity realized by the implementation of information systems
1.6.3 Assess the importance of new technologies to future developments and to the future knowledge worker productivity
1.6.4 Identify new and emerging drivers and inhibitors of information technology change

# Unit 2: Computer Applications

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science, Communications
**RC:** CCNA-Curr, MOUS, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 2.1: Create documents using word processing software**

*Competency Builders:*

2.1.1 Demonstrate proficiency in keyboarding skills
2.1.2 Retrieve existing documents
2.1.3 Create documents (e.g., letters, memos, reports) using existing forms and templates
2.1.4 Safeguard documents using name and save functions
2.1.5 Format text using basic formatting functions (e.g., page setup, tabs, bullets, page numbers, font enhancements, cut and paste)
2.1.6 Check documents using print preview functions
2.1.7 Locate/replace text using search and replace functions
2.1.8 Create new word processing forms, style sheets, and templates
2.1.9 Employ word processing utility tools (e.g., spell checker, grammar checker, thesaurus)
2.1.10 Create tables using table functions (e.g., setup, formatting, editing)
2.1.11 Create columns using column functions (e.g., setup, formatting, editing)
2.1.12 Create outlines
2.1.13 Create footnotes and endnotes
2.1.14 Create macros
2.1.15 Run macros
2.1.16 Assemble documents using merge functions (e.g., merge address files with letters and envelopes)
2.1.17 Format text using advanced formatting features (e.g., headers/footers/dropped caps, indexing)
2.1.18 Print materials using print functions (e.g., number of copies, duplexing or one-sided, selected pages or whole document)
2.1.19 Verify accuracy of output
2.1.20 Edit documents
2.1.21 Access needed information using word processing help screens

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science
**RC:** MOUS

| EDU: | 10 | 12 | AD |
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**Competency 2.2: Create relational databases**

*Competency Builders:*

2.2.1 Design a simple database in accordance with written and/or oral specifications
2.2.2 Create a database table
2.2.3 Edit the design of a database table
2.2.4 Edit the content of a database table (e.g., add, delete, and modify records)
2.2.5 Search a table to locate records
2.2.6 Sort data in a single field
2.2.7 Enter data using a form
2.2.8 Create/modify a form
2.2.9 Perform single- and multiple-table queries (e.g., create, run, save)
2.2.10 Create calculated fields
2.2.11 Generate customized reports for database files
2.2.12 Process data using database functions (e.g., structure, format, attributes, relationships, and keys)
2.2.13 Locate/replace data using search and replace functions
2.2.14 Print forms, reports, and results of queries
2.2.15 Verify accuracy of output
2.2.16 Sort date using multiple-field sorts
2.2.17 Add/remove filters
2.2.18 Create multiple criteria expressions
2.2.19 Create adjoined files
2.2.20 Index files
2.2.21 Create subforms
2.2.22 Group data in reports
2.2.23 Create graphs
2.2.24 Alter the appearance of a form by adding objects or properties
2.2.25 Identify the relationship between database components
2.2.26 Design a database to meet the needs of an actual situation or business problem
2.2.27 Evaluate database design and functionality

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science
**RC:** MOUS, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 2.3: Create spreadsheets**

*Competency Builders:*

2.3.1 Design a spreadsheet in accordance with written and/or oral specifications
2.3.2 Create spreadsheets
2.3.3 Retrieve existing spreadsheets
2.3.4 Check spreadsheets using print preview functions
2.3.5 Format spreadsheets using basic formatting functions (e.g., page setup)
2.3.6 Perform calculations using simple formulas
2.3.7 Edit spreadsheets
2.3.8 Create charts and graphs from spreadsheets
2.3.9 Group worksheets
2.3.10 Delete within spreadsheets
2.3.11 Move/copy within spreadsheets
2.3.12 Input/process data using spreadsheet functions
2.3.13 Improve spreadsheet display using enhancement features
2.3.14 Protect data using spreadsheet protection features
2.3.15 Record macros
2.3.16 Run macros
2.3.17 Troubleshoot spreadsheet problems
2.3.18 Resolve function errors as needed
2.3.19 Apply advanced spreadsheet formulas
2.3.20 Create spreadsheet solutions to business problems
2.3.21 Make "*what if*—" business decisions using spreadsheets as a tool
2.3.22 Save spreadsheets
2.3.23 Access needed information using online help features
2.3.24 Print spreadsheets

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science, Communications
**RC:** MOUS

| EDU: | 10 | 12 | AD |
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**Competency 2.4: Perform desktop publishing functions**

*Competency Builders:*

2.4.1 Prepare publications using desktop publishing software
2.4.2 Format new desktop publishing files
2.4.3 Enter information directly into document
2.4.4 Place preformatted text into document
2.4.5 Place graphics in document
2.4.6 Employ draw boxes
2.4.7 Create graphics files using clip art
2.4.8 Import scanned files
2.4.9 Enhance publications using different fonts, styles, attributes, justification, etc.
2.4.10 Enhance publications using paint/draw functions
2.4.11 Create two-sided documents
2.4.12 Perform editing functions
2.4.13 Set up master pages
2.4.14 Output desktop publishing files

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science, Communications
**RC:** CCNA-Curr, MOUS, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| NS | | P | |
| PSD | | P | |
| IM | | P | |

**Competency 2.5: Create presentations using presentation graphics software**

*Competency Builders:*

2.5.1 Identify hardware items that support presentation software (e.g., scanners, digital cameras, printers, and projection systems)
2.5.2 Compare/contrast various presentation software packages
2.5.3 Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication
2.5.4 Edit presentations
2.5.5 Copy from one presentation to another
2.5.6 Print a single slide, an entire presentation, an outline, and notes

2.5.7 Insert clip art in a slide
2.5.8 Create word art objects
2.5.9 Insert word art objects
2.5.10 Create/modify a graph on a slide
2.5.11 Add a template to a presentation
2.5.12 Remove a template from a presentation
2.5.13 Create graphics documents using drawing and painting software programs
2.5.14 Add transitions to slide shows
2.5.15 Run slide shows manually and automatically
2.5.16 Save slide show presentations

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science
**RC:** MOUS, CNA, CNE, NKC

| **EDU:** | 10 | 12 | AD |
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| ISS | | P | |
| NS | | P | |
| PSD | | P | |
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**Competency 2.6: Integrate computer applications**

*Competency Builders:*

2.6.1 Analyze problems requiring solutions involving the integration of computer applications
2.6.2 Select appropriate productivity tool for solving specific problem
2.6.3 Select *source* application and *destination* application
2.6.4 Move/copy information between integrated applications
2.6.5 Link objects between applications
2.6.6 Embed information in applications

# Unit 3: Data Communications

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
| NS | | P | |
| PSD | | P | |
| IM | | P | |

**Competency 3.1: Demonstrate knowledge of basic data communications components and trends**

*Competency Builders:*

3.1.1 Demonstrate knowledge of key communications procedures
3.1.2 Demonstrate knowledge of the uses of data communication equipment
3.1.3 Demonstrate knowledge of types of communications media
3.1.4 Demonstrate knowledge of data transmission codes and protocols
3.1.5 Distinguish between local area networks and wide-area networks
3.1.6 Identify data communication trends
3.1.7 Identify major current issues in data communications

BIL: Essential – ISS, NS, PSD, IM
AC: Science
RC: A+, CCNA-Curr, **MOUS**, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
| NS | | P | |
| PSD | | P | |
| IM | | P | |

**Competency 3.2: Access information using electronic sources**

*Competency Builders:*

3.2.1 Demonstrate knowledge of how to conduct searches using electronic sources (e.g., selection of search terms)
3.2.2 Access information using telecommunications software
3.2.3 Access information using teleconferencing/video conferencing techniques
3.2.4 Access information using CD-ROM technology
3.2.5 Demonstrate knowledge of the uses of virtual reality as an information source
3.2.6 Access information using a public information retrieval service
3.2.7 Evaluate the quality and usability of electronic information
3.2.8 Download information

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** A+, MOUS, MCP, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | P | | |
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| PSD | P | | |
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**Competency 3.3: Demonstrate proficiency with electronic mail**

*Competency Builders:*

3.3.1 Demonstrate knowledge of the basic purposes of e-mail systems
3.3.2 Demonstrate knowledge of basic e-mail features and options
3.3.3 Demonstrate knowledge of security issues and guidelines for legal usage of e-mail
3.3.4 Demonstrate knowledge of contamination protection strategies for e-mail
3.3.5 Identify available e-mail systems and the characteristics/features of each
3.3.6 Access e-mail system using login and password functions
3.3.7 Access e-mail messages received
3.3.8 Access e-mail attachments
3.3.9 Demonstrate knowledge of e-mail etiquette
3.3.10 Create e-mail messages in accordance with established business standards (e.g., grammar, word usage, spelling, sentence structure, clarity, e-mail etiquette)
3.3.11 Send e-mail messages
3.3.12 Assign priority levels to messages
3.3.13 Create distribution lists
3.3.14 Employ e-mail options such as "reply requested" and "out-of-office reply"
3.3.15 Reply to e-mail messages
3.3.16 Forward e-mail messages
3.3.17 Attach documents to messages
3.3.18 Create folders for organizing messages and documents
3.3.19 Save e-mail messages/attachments
3.3.20 Delete e-mail messages
3.3.21 Print e-mail messages/attachments
3.3.22 Access needed information using e-mail help facilities and tools

# Unit 4: Programming Theory

**BIL:** Essential – ISS, PSD
**AC:**
**RC:** MOUS, MCP, MCSD, CNA, CNE

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
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**Competency 4.1: Demonstrate knowledge of programming language concepts**

*Competency Builders:*

4.1.1 Demonstrate knowledge of the concept of physical representation of digitized information (e.g., data, text, image, voice)

4.1.2 Demonstrate knowledge of the hardware-software connection

4.1.3 Demonstrate knowledge of the concepts of data and procedural representation

4.1.4 Analyze programming languages

4.1.5 Demonstrate knowledge of the function and operation of compilers and interpreters

4.1.6 Demonstrate knowledge of the basic principles for analyzing a programming language

4.1.7 Demonstrate knowledge of the basics of structured, object-oriented, and event-driven programming

4.1.8 Demonstrate knowledge of how a programming language can support multitasking and exception-handling

4.1.9 Demonstrate knowledge of current key programming languages and the environment they are used in (e.g., C, C$^{++}$, Visual Basic, Java, RPG, COBOL, Assembler)

**BIL:** Essential – ISS, PSD
**AC:** Mathematics
**RC:** MOUS, MCP, MCSD, CNE

| EDU: | 10 | 12 | AD |
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**Competency 4.2: Apply the process of algorithm and structured code development**

*Competency Builders:*

4.2.1 State a problem identifying desired outputs for given inputs

4.2.2 Provide an overview of problem to be solved

4.2.3 Describe the fundamental data types and their operations

4.2.4 Design program logic using both graphical and pseudocode techniques

4.2.5 Translate data structures and program design into code in a programming language

4.2.6 Perform mathematical calculations using operators

**BIL:** Essential – PSD Recommended – ISS
**AC:**
**RC:** MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| PSD | I | P | |

**Competency 4.3: Demonstrate knowledge of the stages of program development**

*Competency Builders:*

4.3.1 Identify the use of program design tools

4.3.2 Demonstrate knowledge of structured/modular programming

4.3.3 Demonstrate knowledge of the information system (IS) life cycle

4.3.4 Demonstrate knowledge of the characteristics and uses of batch processing

4.3.5 Demonstrate knowledge of the characteristics and uses of interactive processing

4.3.6 Demonstrate knowledge of the characteristics and uses of event-driven, object-oriented processing

**BIL:** Essential – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| PSD | I | P | |

**Competency 4.4: Demonstrate knowledge of technical documentation associated with software development**

*Competency Builders:*

4.4.1 Secure needed information using appropriate reference materials

4.4.2 Analyze specifications

4.4.3 Identify constraints

4.4.4 Identify input and output (I/O) requirements

4.4.5 Prepare logic using a program flowchart

# Unit 5: Applied Programming Languages

**Each competency must be addressed in at least two of the following language types:**

- Structural/Procedural (e.g., Basic, C, Visual Basic, RPG, COBOL)
- Object-Oriented (e.g., Java, C++)
- Scripting/Control (e.g., JLL, Perl)
- Data Description (e.g., IOL, SQL)
- Machine Level (e.g., Assembly)
- Mark-up (e.g., HTML, SML, SGML)

**BIL:** Essential – ISS, PSD
**AC:** Mathematics
**RC:** CCNA, CCNA-Curr, MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
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**Competency 5.1: Apply computational and logical operations**

*Competency Builders:*

5.1.1 Develop programs that use arithmetic operations
5.1.2 Develop programs that use relational operators and compound conditions
5.1.3 Develop programs that use control breaks
5.1.4 Develop programs that use subtotals and final totals

**BIL:** Essential – ISS, PSD
**AC:**
**RC:** MCP, MCSD

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | P | |

**Competency 5.2: Apply techniques for building applications**

*Competency Builders:*

5.2.1 Demonstrate knowledge of development environment (ISS)
5.2.2 Use editors (ISS)
5.2.3 Compile or interpret applications into runable form (ISS)
5.2.4 Run application (ISS)

**BIL:** Essential – ISS, PSD
**AC:**
**RC:** MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
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**Competency 5.3: Apply language specific programming techniques**

*Competency Builders:*

5.3.1 Develop programs using desired language (ISS)
5.3.2 Incorporate the use of sort routines (ISS)
5.3.3 Develop programs designed to create, update, and delete records (ISS)
5.3.4 Develop programs using menus (ISS)
5.3.5 Develop programs that require user input (ISS)
5.3.6 Demonstrate knowledge of key constructs and commands specific to the language (ISS)
5.3.7 Compile program (ISS)
5.3.8 Test program (ISS)
5.3.9 Correct errors (ISS)

**BIL:** Essential – ISS, PSD
**AC:**
**RC:** MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | P | |

**Competency 5.4: Debug programs**

*Competency Builders:*

5.4.1 Test/run program (ISS)
5.4.2 Correct syntax errors (ISS)
5.4.3 Debug compiler errors (ISS)
5.4.4 Correct common run-time errors (ISS)
5.4.5 Debug complex logic errors (ISS)
5.4.6 Maintain legacy applications (ISS)

# Unit 6: Computer User Support

**BIL:** Essential – ISS, NS, PSD
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 6.1: Analyze technical support needed**

*Competency Builders:*

6.1.1 Identify support requirements ((ISS, NS, PSD)
6.1.2 Apply information and data analysis techniques (NS)
6.1.3 Identify skill level needs (ISS, NS, PSD)
6.1.4 Define scope of work to meet customer needs (ISS, NS, PSD)
6.1.5 Identify resources and risks (NS, PSD)
6.1.6 Evaluate present data and system configuration (NS)
6.1.7 Formulate a support plan (NS, PSD)
6.1.8 Communicate and document technical support provided (NS)

**BIL:** Essential – ISS, NS, PSD
**AC:** Communications
**RC:** A+, **CCNA**, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 6.2: Perform customer service**

*Competency Builders:*

6.2.1 Provide high-level technical support (NS)
6.2.2 Respond to user questions (NS, PSD)
6.2.3 Provide troubleshooting for hardware/software (NS, PSD)
6.2.4 Track information within the system (NS)
6.2.5 Perform system-tuning functions (NS, PSD)
6.2.6 Diagnose problems within system (NS, PSD)
6.2.7 Perform technical functions required by customer/user (NS, PSD)
6.2.8 Employ technical and computer tools to perform task in the most cost-effective manner (NS)
6.2.9 Manage working relationships with customer within support boundaries (PSD)
6.2.10 Balance resources against customer needs
6.2.11 Manage multiple customer requirements (PSD)
6.2.12 Establish liaison communication with all users

**BIL:** Essential – ISS
**AC:** Science, Communications
**RC:** A+, **CCNA-Curr**, CNA, CNE, NKC

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |

**Competency 6.3: Provide support and training**

*Competency Builders:*

6.3.1 Operate help desk
6.3.2 Employ desktop productivity tools
6.3.3 Support computer users
6.3.4 Train computer users
6.3.5 Manage user accounts
6.3.6 Maintain documentation
6.3.7 Prepare status reports
6.3.8 Maintain training manuals

# Unit 7: Software Development

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics
**RC:** MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | | I | P |

**Competency 7.1: Demonstrate knowledge of software development methodology**

*Competency Builders:*

7.1.1 Identify basic concepts of algorithm development and programming (PSD)

7.1.2 Demonstrate knowledge of how to complete project (given formal specifications) requiring incorporation of control structures(PSD)

7.1.3 Demonstrate knowledge of the principles of program design (e.g., structured, object-oriented, event-driven) (PSD)

7.1.4 Demonstrate knowledge of different data types (e.g., numeric, alphanumeric) (PSD)

7.1.5 Demonstrate knowledge of the software design process (e.g., specification through implementation and testing) (PSD)

7.1.6 Demonstrate knowledge of how to resolve program implementation issues (e.g., debugging, documentation, auditing) (PSD)

7.1.7 Demonstrate knowledge of software development issues (e.g., correctness, reliability, and productivity) (PSD)

7.1.8 Demonstrate knowledge of the system life-cycle approach

7.1.9 Demonstrate knowledge of the use, structure, and contents of a requirements specification document

7.1.10 Demonstrate knowledge of how to use a structured methodology to analyze a real-world problem

7.1.11 Demonstrate knowledge of how dataflow diagrams, process specifications, and a data dictionary are used to model functional requirements

7.1.12 Demonstrate knowledge of how Jackson diagrams, entity relationship diagrams, and relations are used to model data requirements

7.1.13 Demonstrate knowledge of nonfunctional requirements (e.g., security, integrity, response time, and reliability)

7.1.14 Demonstrate knowledge of how to use computer-aided software engineering (CASE) tools

7.1.15 Demonstrate knowledge of project budgeting, scheduling, and control issues related to software development

7.1.16 Demonstrate knowledge of different system design models (e.g., client server, centralized)

7.1.17 Demonstrate knowledge of system analysis issues related to design, testing, implementation, and maintenance

7.1.18 Demonstrate knowledge of how to design and implement programs in a top-down manner (PSD)

7.1.19 Demonstrate knowledge of how to use algorithmic and modular design to develop a problem solution

7.1.20 Demonstrate knowledge of how concepts of modular design are used to define cohesive modules (PSD)
7.1.21 Demonstrate knowledge of how programming control structures are used to verify correctness (PSD)
7.1.22 Demonstrate knowledge of data normalization
7.1.23 Demonstrate knowledge of memory management theories (PSD)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Communications
**RC:**

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | I | P |

**Competency 7.2: Demonstrate knowledge of basic software systems design**

*Competency Builders:*

7.2.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts) (PSD)
7.2.2 Analyze documentation, forms, notes, and source data (PSD)
7.2.3 Identify constraints (PSD)
7.2.4 Identify system processing requirements (PSD)
7.2.5 Identify input and output (I/O) requirements (PSD)
7.2.6 Design system inputs, outputs, and processes (PSD)
7.2.7 Prepare logic using program flowchart (PSD)
7.2.8 Define variables (PSD)
7.2.9 Select programming language (PSD)
7.2.10 Create design documentation (PSD)
7.2.11 Prepare printer spacing chart (PSD)
7.2.12 Design implementation plan
7.2.13 Design project plan
7.2.14 Prepare dataflow diagram
7.2.15 Present system design to management
7.2.16 Present system design to users
7.2.17 Select computer-aided software engineering (CASE) tools
7.2.18 Review design (e.g., peer and/or user walkthrough)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | I | P |

**Competency 7.3: Develop software requirements/specifications**

*Competency Builders:*

7.3.1 Access needed information using company references (e.g., procedural manuals, documentation, standards, work flowcharts) (PSD)
7.3.2 Analyze requirements/specifications using current approaches (e.g., structured analysis, object-oriented analysis, prototyping, Jackson System Development)
7.3.3 Divide design specifications into logical process blocks
7.3.4 Identify parameters
7.3.5 Clarify specifications using questioning techniques
7.3.6 Follow specifications or drawings (PSD)
7.3.7 Record process (e.g., using flowchart, step-by-step narrative) (PSD)
7.3.8 Record data (PSD)
7.3.9 Gather information using interviewing strategies (PSD)
7.3.10 Identify system requirements
7.3.11 Develop informal specifications
7.3.12 Develop formal specifications
7.3.13 Identify documentation needs
7.3.14 Identify computing standards and methodologies
7.3.15 Identify security measures

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics, Communications
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | I | P | |

**Competency 7.4: Code programs**

*Competency Builders:*

7.4.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)
7.4.2 Prepare detailed flowchart for coding program
7.4.3 Design program solution using pseudocode
7.4.4 Generate source code using programming tools in accordance with established standards (e.g., BASIC, COBOL, RPG, C)
7.4.5 Code error-handling techniques
7.4.6 Access data using external sequential, indexed sequential, random, and direct file methods

7.4.7 Apply logical operators (e.g., AND, OR, NOT)
7.4.8 Perform program sorts
7.4.9 Develop programs in higher-level languages (e.g., C++, Visual Basic)
7.4.10 Generate executable code
7.4.11 Debug compilation errors
7.4.12 Review code with peers or design team
7.4.13 Apply security measures
7.4.14 Apply computer-aided software engineering (CASE) tools and reverse engineering
7.4.15 Develop dataflow designs and translate them to pseudocode
7.4.16 Translate a logical system design into a physical design in a real environment
7.4.17 Report progress based on time line

**BIL:** Essential – PSD Recommended – ISS
**AC:** Communications
**RC:**

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | I | P |

**Competency 7.5: Execute software testing, validation, change control, defect tracking, and documentation**

*Competency Builders:*

7.5.1 Access needed information (PSD)
7.5.2 Develop comprehensive test plan (PSD)
7.5.3 Develop test system (PSD)
7.5.4 Develop test procedures (PSD)
7.5.5 Perform tests (PSD)
7.5.6 Document errors (PSD)
7.5.7 Perform regression tests
7.5.8 Update design documentation (PSD)
7.5.9 Prepare program documentation (PSD)
7.5.10 Prepare user documentation
7.5.11 Perform user-acceptance test
7.5.12 Validate user documentation
7.5.13 Review results with customer/user
7.5.14 Report progress based on time line (PSD)

**BIL:** Recommended – ISS
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |

**Competency 7.6: Execute software product release and follow-up**

*Competency Builders:*

7.6.1 Obtain user acceptance
7.6.2 Participate in development of release plan
7.6.3 Train technical support staff
7.6.4 Facilitate transition to the new system
7.6.5 Participate in development of a user training plan
7.6.6 Evaluate defects
7.6.7 Repair defects
7.6.8 Document defects and repairs
7.6.9 Implement enhancements
7.6.10 Evaluate enhancements
7.6.11 Document enhancements
7.6.12 Obtain user feedback
7.6.13 Evaluate users' concerns
7.6.14 Respond to users' concerns

**BIL:** Recommended – ISS, PSD
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
| PSD | | | I |

**Competency 7.7: Complete team software engineering project**

*Competency Builders:*

7.7.1 Demonstrate knowledge of the principles and applications of software development team organization
7.7.2 Gather data to identify customer requirements
7.7.3 Estimate product life or customer application
7.7.4 Evaluate functional requirements
7.7.5 Interpret functional requirements analysis
7.7.6 Define scope of work to meet customer requirements
7.7.7 Identify time, technology, and resource constraints
7.7.8 Estimate project costs
7.7.9 Apply project planning and scheduling techniques to project development
7.7.10 Generate design alternatives
7.7.11 Evaluate design alternatives
7.7.12 Define system and software requirements

7.7.13 Validate system requirements
7.7.14 Establish measurable performance requirements
7.7.15 Develop software product and project documentation
7.7.16 Perform software product and project document composition and evaluation
7.7.17 Conduct software product testing and debugging
7.7.18 Conduct technical review

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | | I |

**Competency 7.8: Apply computer simulation techniques**

*Competency Builders:*

7.8.1 Demonstrate knowledge of methods for comparing systems using random data
7.8.2 Demonstrate knowledge of simulation techniques and the analysis of simulation results
7.8.3 Demonstrate knowledge of experimental design techniques
7.8.4 Develop experimental designs
7.8.5 Employ random number generation
7.8.6 Demonstrate knowledge of random variate generation
7.8.7 Demonstrate given simulations using a simulator
7.8.8 Apply queuing systems to a simulation

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics
**RC:** MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | I | P |

**Competency 7.9: Demonstrate knowledge of data structures**

*Competency Builders:*

7.9.1 Demonstrate knowledge of techniques for data abstraction
7.9.2 Demonstrate knowledge of program design using abstraction
7.9.3 Demonstrate knowledge of data structures (e.g., arrays and records, lists, trees, hashing, priority queues and heaps, equivalence relations, and graphs) as they apply to simulation (PSD)
7.9.4 Analyze mathematically the efficiency of algorithms that manipulate and use data structures in searching, sorting, dictionary operations, and graphing
7.9.5 Estimate algorithm efficiency using basic database concepts

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
| PSD | | | I |

**Competency 7.10: Demonstrate knowledge of knowledge-based (expert) systems**

*Competency Builders:*

7.10.1 Demonstrate knowledge of problem analysis and diagnosis methods
7.10.2 Apply task-level analysis and problem-solving methods to classification problems
7.10.3 Apply task-level analysis and problem-solving methods to configuration (design) problems
7.10.4 Identify methods for representing and reasoning with uncertain knowledge
7.10.5 Demonstrate knowledge of inference-processing basic control strategies (e.g., depth-first, breadth-first)
7.10.6 Apply forward and backward reasoning to system development
7.10.7 Demonstrate knowledge of heuristic search strategies
7.10.8 Differentiate between expert systems and shells
7.10.9 Demonstrate knowledge of task-level architectures
7.10.10 Employ knowledge system development tools

**BIL:** Recommended – ISS, PSD
**AC:** Science, Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | | I |

**Competency 7.11: Demonstrate basic knowledge of artificial intelligence (AI)**

*Competency Builders:*

7.11.1 Demonstrate knowledge of the history, scope and limits of AI, including Turing's test
7.11.2 Demonstrate knowledge of AI terminology and concepts
7.11.3 Demonstrate knowledge of the fundamentals of AI problem solving
7.11.4 Demonstrate knowledge of the fundamentals of knowledge representation logic
7.11.5 Demonstrate knowledge of knowledge-based systems involving natural language, speech, and vision
7.11.6 Demonstrate knowledge of the terminology and concepts related to visual perception and computer vision
7.11.7 Demonstrate knowledge of pattern recognition theory
7.11.8 Demonstrate knowledge of machine learning theory
7.11.9 Demonstrate knowledge of robotics
7.11.10 Demonstrate knowledge of neural networks
7.11.11 Demonstrate knowledge of rule-based systems and cognitive modeling

7.11.12 Demonstrate knowledge of the computational techniques used in typical artificial intelligence subareas
7.11.13 Demonstrate knowledge of the construction of intelligent machines
7.11.14 Identify current research topics in artificial intelligence

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | | I |

**Competency 7.12: Demonstrate basic knowledge of computational complexity (computability and unsolvability)**

*Competency Builders:*

7.12.1 Demonstrate knowledge of Turing machines and computability
7.12.2 Demonstrate knowledge of Turing machine construction
7.12.3 Demonstrate knowledge of Turing machine variants
7.12.4 Demonstrate knowledge of the Church-Turing thesis and its implications
7.12.5 Demonstrate knowledge of reductions between languages
7.12.6 Demonstrate knowledge of decidability and Turing recognizability
7.12.7 Demonstrate knowledge of the recursion theorem
7.12.8 Demonstrate knowledge of time and space complexity measures
7.12.9 Differentiate between nondeterministic and deterministic complexity
7.12.10 Demonstrate knowledge of techniques for proving problems hard/complete
7.12.11 Demonstrate knowledge of basic complexity classes (e.g., LOG, NLOG, P, NP, co-NP, PSPACE, EXP)
7.12.12 Demonstrate knowledge of randomized computation
7.12.13 Demonstrate knowledge of public-key cryptosystems and cryptography
7.12.14 Demonstrate knowledge of approximation algorithms
7.12.15 Demonstrate knowledge of parallel complexity classes

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
| PSD | | | I |

**Competency 7.13: Apply basic knowledge of parallel computing**

*Competency Builders:*

7.13.1 Identify models of parallel computers
7.13.2 Demonstrate knowledge of basic concepts of parallel computing (e.g., design, implementation, evaluation for shared-memory architectures, local-memory architectures, and vector processors)
7.13.3 Demonstrate knowledge of basic communication operations
7.13.4 Demonstrate knowledge of parallel algorithm design and analysis
7.13.5 Demonstrate knowledge of problem solving on parallel computers
7.13.6 Demonstrate knowledge of performance and scalability of parallel systems
7.13.7 Perform parallel programming
7.13.8 Solve sparse systems of linear equations
7.13.9 Demonstrate sorting ability
7.13.10 Perform fast Fornier transforms
7.13.11 Operate advanced parallel computers (e.g., Cray Y-MP, Cray T3D, IBM SP2 and Convex SPP 12200)

# Unit 8: Software Systems Management

**BIL:** Essential – ISS, NS, PSD Recommended – IM
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MOUS, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| NS | I | P | |
| PSD | I | P | |
| IM | | P | |

**Competency 8.1: Install/configure software programs**

*Competency Builders:*

8.1.1 Identify hardware requirements (e.g., processor, memory, disk space, communications, printers, monitors)
8.1.2 Determine compatibility of hardware and software
8.1.3 Install given application/system software on various platforms in accordance with manufacturer's procedures
8.1.4 Access needed help using manufacturers' technical help lines or Internet sites
8.1.5 Disable/uninstall software that may interfere with installation of new software
8.1.6 Verify conformance to licensing agreement
8.1.7 Differentiate between procedures for an upgrade and for a new installation
8.1.8 Differentiate between stand-alone and network installation procedures
8.1.9 Select appropriate installation options (e.g., default, customized)
8.1.10 Configure software to appropriate operating system settings
8.1.11 Troubleshoot unexpected results
8.1.12 Formulate new installation procedure if needed
8.1.13 Customize software to meet user preferences
8.1.14 Document step-by-step installation and configuration procedures
8.1.15 Verify software installation and operation
8.1.16 Convert data files if required
8.1.17 Configure macros, tools, and packages to accomplish simple organizational and personal tasks

**BIL:** Essential – ISS, PSD Recommended – NS, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | | | I |
| PSD | | I | P |
| IM | | | I |

**Competency 8.2: Perform configuration management activities**

*Competency Builders:*

8.2.1 Demonstrate knowledge of identification and control functions (PSD)
8.2.2 Demonstrate knowledge of version management and interface control
8.2.3 Select appropriate tools for configuration management (PSD)
8.2.4 Determine standards to be applied (e.g., international, industry, military) (PSD)
8.2.5 Specify baseline and software life-cycle phases
8.2.6 Assess the impact of changes that affect interfaces

**BIL:** Essential – ISS, PSD Recommended – NS, IM
**AC:** Communications
**RC:** CNA, CNE

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | | I |
| PSD | | I | P |
| IM | | I | P |

**Competency 8.3: Evaluate application software packages**

*Competency Builders:*

8.3.1 Perform work flow analysis to determine user needs (ISS, PSD)
8.3.2 Compare/contrast ease of learning, use, and interfacing for different software packages (ISS, PSD)
8.3.3 Compare/contrast performance and features of different software packages (e.g., speed of retrieval, copying, saving, speller, thesaurus, moving, sorting) (ISS, PSD)
8.3.4 Compare/contrast ease of technical support for different software packages (PSD)
8.3.5 Compare/contrast clarity of documentation for different software packages (PSD)
8.3.6 Compare/contrast licensing agreements for different software packages (ISS, PSD)
8.3.7 Document results of the software evaluation (ISS)
8.3.8 Perform a software configuration audit
8.3.9 Perform a physical configuration audit
8.3.10 Evaluate appropriateness of software for specific projects (ISS)

| | |
|---|---|
| 8.3.11 | Prepare a cost-benefit analysis for a software package (ISS) |
| 8.3.12 | Develop a method for evaluation |
| 8.3.13 | Test the functionality of proposed software configuration |

# Unit 9: Appreciation of the Arts

**BIL:** Recommended – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | IR |

**Competency 9.1: Demonstrate knowledge of and an appreciation for music**

*Competency Builders:*

9.1.1 Compare/contrast the role of music in different historical periods
9.1.2 Assess the role of music in contemporary living
9.1.3 Compare/contrast the function of music in different cultures
9.1.4 Demonstrate knowledge of the basic physical properties of sound (e.g., pitch, intensity, duration, and timbre)
9.1.5 Demonstrate knowledge of the various elements of music (e.g., rhythm, melody, harmony, tone, color, and form)
9.1.6 Demonstrate knowledge of how musical elements relate to the meaning or content of a composition
9.1.7 Identify the feelings conveyed by various musical elements (e.g., thematic construction, tonal color, instruments, texture, volume, and tempo)

**BIL:** Recommended – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | IR |

**Competency 9.2: Demonstrate knowledge of and an appreciation for the visual arts**

*Competency Builders:*

9.2.1 Compare/contrast the visual art styles of various historical periods
9.2.2 Define various forms of visual art
9.2.3 Demonstrate knowledge of the various elements of visual arts (e.g., lines, colors, light and dark, texture, volume, perspective)
9.2.4 Identify the feelings conveyed by various elements of visual arts

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | IR |

**Competency 9.3: Make use of the interaction between music and visual art**
*Competency Builders:*
9.3.1 Identify uses of music visualization
9.3.2 Combine selected music and visuals to evoke a specific emotional response

**BIL:** Recommended – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | IR |

**Competency 9.4: Demonstrate knowledge of and an appreciation for literature**
*Competency Builders:*
9.4.1 Compare/contrast the role of literature in different historical periods
9.4.2 Assess the role of literature in contemporary living
9.4.3 Compare/contrast the function of literature in different cultures
9.4.4 Analyze the impact of literature on the business environment
9.4.5 Demonstrate knowledge of the basic themes used in literature
9.4.6 Demonstrate knowledge of the basic styles/genres of literature
9.4.7 Identify the basic elements of a story (e.g., plot, characters, and setting)
9.4.8 Analyze the themes and styles used in interactive stories

# Unit 10: Graphic Design Fundamentals

**BIL:** Essential – IM
**AC:** Mathematics, Communications
**RC:** NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 10.1: Demonstrate basic technical art skills (traditional and electronic)**
*Competency Builders:*

10.1.1 Make computations for centering, spacing, and scaling drawings
10.1.2 Employ various types of drawing media and a variety of surfaces
10.1.3 Employ various mechanical drawing equipment
10.1.4 Interpret information from drawings, prints, and sketches
10.1.5 Draw freehand sketches
10.1.6 Draw auxiliary views
10.1.7 Draw one- and two-point perspectives
10.1.8 Alter drawings
10.1.9 Create charts, graphs, and diagrams
10.1.10 Evaluate drawings
10.1.11 Make collages

**BIL:** Essential – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 10.2: Demonstrate knowledge of design principles**
*Competency Builders:*

10.2.1 Demonstrate knowledge of the two-dimensional picture plan
10.2.2 Demonstrate knowledge of the principles and elements of design and their relationship to each other
10.2.3 Demonstrate knowledge of the nature of color and color harmonies
10.2.4 Assess the impact of various color harmonies on a two-dimensional picture plan
10.2.5 Assess how color affects the principles of line, value, shape and form

**BIL:** Essential – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 10.3: Demonstrate design skills**

*Competency Builders:*

10.3.1 Apply elements of design (e.g., line, shape, color) (IM)
10.3.2 Apply principles of design (e.g., proportion, balance, harmony, rhythm, unity) (IM)
10.3.3 Apply color theory (IM)
10.3.4 Use tones, hues, and values (IM)
10.3.5 Develop thumbnail concepts (IM)
10.3.6 Develop rough and comprehensive layouts (IM)
10.3.7 Paint freehand or within sketched designs using mixed colors (IM)
10.3.8 Apply color for impact (IM)
10.3.9 Determine appropriate uses of halftone, duotone, and multi-color processes (IM)
10.3.10 Create symmetric and asymmetric designs (IM)
10.3.11 Create various mock-ups and dummies (IM)
10.3.12 Select appropriate style for desired impact (IM)
10.3.13 Make collages (IM)

**BIL:** Essential – IM
**AC:**
**RC:** MOUS

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 10.4: Demonstrate knowledge of available graphics software programs**

*Competency Builders:*

10.4.1 Compare/contrast different types of graphics software (IM)
10.4.2 Demonstrate knowledge of graphic tools, menus, and functions, such as grouping, transformations and blending (IM)
10.4.3 Demonstrate knowledge of simple and advanced development tools, styles, templates, and wizards (IM)
10.4.4 Demonstrate knowledge of simple and advanced techniques for manipulating object attributes and types (IM)
10.4.5 Select the most effective graphics software for the intended uses (IM)

**BIL:** Essential – IM
**AC:** Mathematics
**RC:** MOUS, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 10.5: Create computer graphics**

*Competency Builders:*

10.5.1 Identify types of graphics (IM)
10.5.2 Define audience and purpose of graphics (IM)
10.5.3 Select the appropriate style of graphics based on the intended purpose (IM)
10.5.4 Create graphics that integrate principles of communication and elements of visual design (IM)
10.5.5 Manipulate color, shape, size, and textures of graphics (IM)
10.5.6 Import objects from other applications (IM)
10.5.7 Export objects to other applications (IM)
10.5.8 Rotate graphics (IM)
10.5.9 Rotate text (IM)
10.5.10 Paint/touch up images (IM)
10.5.11 Add/subtract image parts (IM)
10.5.12 Apply 2-D and 3-D graphics principles (IM)
10.5.13 Manipulate multiple image layers (IM)
10.5.14 Employ masking techniques (IM)
10.5.15 Crop images (IM)
10.5.16 Scale images (IM)
10.5.17 Employ various filtration methods (IM)
10.5.18 Convert raster to vector images (IM)
10.5.19 Store images in appropriate formats and resolutions for specific applications (IM)
10.5.20 Save/retrieve graphics (IM)
10.5.21 Print graphics to various output devices (IM)

**BIL:** Essential – IM
**AC:** Mathematics
**RC:** MOUS

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 10.6: Apply knowledge of typography**

*Competency Builders:*

10.6.1 Demonstrate knowledge of typography materials
10.6.2 Interpret typographic terms
10.6.3 Demonstrate knowledge of typographic methods
10.6.4 Demonstrate knowledge of proofreaders' marks
10.6.5 Demonstrate knowledge of picas, points, and their conversion to inches
10.6.6 Demonstrate knowledge of specification of type and copy fitting

| | |
|---|---|
| 10.6.7 | Identify typographic styles |
| 10.6.8 | Define basic letter structures |
| 10.6.9 | Mix families of type within a project |
| 10.6.10 | Interpret typographical specifications |
| 10.6.11 | Select proper letter and line spacing |
| 10.6.12 | Select appropriate typefaces |
| 10.6.13 | Prepare type formats (e.g., style sheets) |
| 10.6.14 | Create templates |

# Unit 11: Photography

**BIL:** Recommended – IM
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | IR |

**Competency 11.1: Operate photographic equipment**

*Competency Builders:*

11.1.1 Differentiate between various camera formats (i.e., traditional vs. digital)
11.1.2 Select appropriate camera format for given situation
11.1.3 Demonstrate knowledge of apertures
11.1.4 Identify the optimum aperture of a lens
11.1.5 Demonstrate knowledge of shutter speeds
11.1.6 Identify the optimum shutter speed for desired exposure effects
11.1.7 Use shutter speed to stop and show motion
11.1.8 Demonstrate knowledge of film speed sequencing
11.1.9 Identify the optimum film speed for desired sensitivity
11.1.10 Calculate equivalent exposures
11.1.11 Identify desired exposure using a hand-held meter
11.1.12 Correct distortion using camera movements
11.1.13 Identify light sources
11.1.14 Provide needed lighting conditions using hand-held electronic flash units
11.1.15 Create photographs using varied films, lighting, and formats
11.1.16 Create photographs using different lenses (e.g., wide-angle, telephoto, zoom)
11.1.17 Create photographs using various lens filters (e.g., light-balancing, color-compensating, polarizing, special effects, black-and-white contrast control)

**BIL:** Recommended – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | | I |

**Competency 11.2: Demonstrate knowledge of photographic language**

*Competency Builders:*

11.2.1 Demonstrate knowledge of the role played by the following photographic elements: composition, formal qualities, scale, use of space, use of light
11.2.2 Demonstrate knowledge of how the meaning of a photograph is affected by composition, formal qualities, scale, use of space, and use of light
11.2.3 Identify the use and meaning of symbolism in given photographs
11.2.4 Identify the use and meaning of metaphor in given photographs

# Unit 12: Digital Media Design

**BIL:** Essential – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.1: Create visual design guidelines**

*Competency Builders:*

12.1.1 Integrate paint illustration program techniques with digital photography imagery (IM)
12.1.2 Consider the visual characteristics of various mediums (IM)
12.1.3 Assess how the technical limitations of the medium affect content and style
12.1.4 Consider the relationship between form and content
12.1.5 Plan a visual design in which form follows function
12.1.6 Create the look and feel of the product (IM)
12.1.7 Combine software utilities in screening for translucency and for layering of multiple images (IM)
12.1.8 Select appropriate colors (IM)
12.1.9 Define color editing capabilities (IM)
12.1.10 Complete basic design (IM)
12.1.11 Represent/simplify 3-D shapes and textures
12.1.12 Integrate human factors and user interface in visual design (IM)
12.1.13 Evaluate visual appeal of design (IM)
12.1.14 Produce simulations (IM)
12.1.15 Evaluate simulations (IM)

**BIL:** Essential – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.2: Apply functional design of digital media to technical presentations**

*Competency Builders:*

12.2.1 Design computer model objects for function (IM)
12.2.2 Deduce design by examination of digital product function (IM)
12.2.3 Prepare functional requirements/specifications (IM)
12.2.4 Select appropriate media types (IM)
12.2.5 Select delivery applications/platforms (IM)
12.2.6 Design necessary system architecture
12.2.7 Design user interface (IM)
12.2.8 Design navigation schema (IM)

12.2.9 Create storyboard(s) (IM)
12.2.10 Create/refine design concepts (IM)
12.2.11 Participate in iterative development with clients and development team members (IM)
12.2.12 Prepare technical presentation as a member of a development team (IM)

**BIL:** Essential – IM
**AC:** Mathematics
**RC:**

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 12.3: Demonstrate proficiency in the use of digital imaging techniques and equipment**

*Competency Builders:*

12.3.1 Demonstrate knowledge of standard hardware platform components and configurations (e.g., UNIX, IBM, Macintosh)
12.3.2 Identify memory and storage requirements
12.3.3 Identify computer architecture requirements for digital imaging
12.3.4 Demonstrate knowledge of parallel/serial transmission
12.3.5 Demonstrate knowledge of how a digital image is generated
12.3.6 Identify types of digital imaging software
12.3.7 Demonstrate knowledge of the characteristics and operation of digital imaging equipment (e.g., scanner, digital camera, video input devices, graphics tablet, graphics expansion board, printer, film recorder, and output devices)
12.3.8 Compare performance of different types of image acquisition hardware
12.3.9 Compare/contrast area and linear arrays
12.3.10 Compare/contrast exposure and multiexposure systems
12.3.11 Demonstrate knowledge of resolution issues
12.3.12 Perform resolution calculations (e.g., number of pixels, number of colors)
12.3.13 Compare/contrast addressable and displayable resolution
12.3.14 Access information needed to operate a given digital camera system using standard print and electronic help tools
12.3.15 Capture images with digital camera
12.3.16 Demonstrate knowledge of archiving and managing images

**BIL:** Essential – IM
**AC:** Mathematics
**RC:** MOUS

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 12.4: Manipulate images**

*Competency Builders:*

12.4.1 Identify image file formats (IM)
12.4.2 Manipulate levels (IM)
12.4.3 Convert file formats (IM)
12.4.4 Manipulate curves (IM)
12.4.5 Manipulate contrast (IM)
12.4.6 Crop images (IM)
12.4.7 Scale images (IM)
12.4.8 Adjust images using various filtration methods (IM)
12.4.9 Adjust images using selection tools (IM)
12.4.10 Adjust images using painting and editing tools (IM)
12.4.11 Manipulate multiple image layers (IM)
12.4.12 Adjust images using masking techniques (IM)
12.4.13 Optimize images for specific uses (IM)

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.5: Demonstrate knowledge of the basic principles of 3-D modeling**

*Competency Builders:*

12.5.1 Demonstrate knowledge of how to convert objects from two-dimensional to three-dimensional
12.5.2 Demonstrate knowledge of how a computer deals with geometry
12.5.3 Identify the software available for 3-D modeling
12.5.4 Demonstrate knowledge of the steps for building a 3-D model
12.5.5 Demonstrate knowledge of the components of a wireframe model

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.6: Create 3-D models**

*Competency Builders:*

12.6.1 Create a model using 3-D modeling software
12.6.2 Determine desired camera angle
12.6.3 Adjust lighting angle, focus, and color to achieve desired effect
12.6.4 Adjust surface color, texture, transparency, and reflectivity to achieve desired effect
12.6.5 Compare/contrast flat shading, curved shading, and ray tracing
12.6.6 Render the object using flat shading
12.6.7 Render the object using curved shading
12.6.8 Render the object using ray tracing
12.6.9 Combine models to create a scene
12.6.10 Render the completed scene

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | | I |

**Competency 12.7: Perform advanced 3-D image generation techniques**

*Competency Builders:*

12.7.1 Follow basic animation principles
12.7.2 Perform basic texture-mapping algorithms
12.7.3 Perform basic antialiasing
12.7.4 Apply ray tracing and radiosity methods
12.7.5 Perform basic volume-rendering algorithms
12.7.6 Perform surface detail modeling
12.7.7 Develop basic curves and surfaces

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.8: Demonstrate knowledge of the basic principles of animation**

*Competency Builders:*

12.8.1 Demonstrate knowledge of the principles of continuity, key frames, motion paths, and motion
12.8.2 Demonstrate knowledge of the uses of special effects and virtual navigation
12.8.3 Identify available animation software programs/tools
12.8.4 Demonstrate knowledge of 2-D sprite animation
12.8.5 Demonstrate knowledge of the principles of cell animation
12.8.6 Demonstrate knowledge of prerendered 3-D animation
12.8.7 Demonstrate knowledge of real-time 3-D animation

**BIL:** Recommended – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.9: Animate characters**

*Competency Builders:*

12.9.1 Demonstrate knowledge of how to design a character based on a narrative context
12.9.2 Demonstrate knowledge of how to animate a character so as to express its nature
12.9.3 Demonstrate knowledge of how to capture motion
12.9.4 Design 2-D characters
12.9.5 Design 3-D models of characters
12.9.6 Develop characters in accordance with designs

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.10: Create 3-D environments**

*Competency Builders:*

12.10.1 Create buildings and rooms
12.10.2 Import buildings and rooms
12.10.3 Create land forms
12.10.4 Import land forms
12.10.5 Create bodies of water (e.g., lakes, rivers, oceans, waterfalls)
12.10.6 Create basic water textures, reflections, refractions, and splashing
12.10.7 Incorporate fog and background images
12.10.8 Manipulate particle systems such as rain and snow
12.10.9 Apply lighting effects
12.10.10 Add special effects

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 12.11: Demonstrate knowledge of virtual reality**

*Competency Builders:*

12.11.1 Demonstrate knowledge of the basic principles of virtual reality
12.11.2 Demonstrate knowledge of the principles of geometry relative to virtual reality
12.11.3 Demonstrate knowledge of virtual reality file formats (e.g., 9SVR, VRML)
12.11.4 Manage polygon resources
12.11.5 Create a basic virtual world
12.11.6 Code object intelligence into a virtual world

# Unit 13: Video/Film Production

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 13.1: Interpret the relationship between the creative and craft skills required for film/video production**

*Competency Builders:*

13.1.1 Identify the working relationships that exist between the various participants involved in the video/film-production process

13.1.2 Demonstrate knowledge of the specific technical processes used by the camera, grip, lighting, sound, art, costume, special effects, make up, and editing departments

13.1.3 Analyze a script to identify technical requirements

13.1.4 Compare/contrast the techniques used in film and video production in studio and field

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | | P |

**Competency 13.2: Perform technical support tasks for a video production**

*Competency Builders:*

13.2.1 Formulate strategies to properly utilize grip equipment during film/video production

13.2.2 Originate solutions to unique shooting problems

13.2.3 Organize pre- and post-production routines

13.2.4 Analyze production requirements to determine grip equipment needs

13.2.5 Create required effects for lighting set-ups

13.2.6 Demonstrate safe work habits

13.2.7 Work as a member of a film production team

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 13.3: Perform camera-related tasks for a video production**

*Competency Builders:*

13.3.1 Analyze the aesthetic needs of a shot and accomplish them
13.3.2 Organize the proper care and handling of camera and camera assist equipment
13.3.3 Analyze the script for camera lens and shot requirements
13.3.4 Organize pre and post-production routines for camera operation
13.3.5 Analyze production requirements to determine camera equipment needs

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 13.4: Perform lighting activities for a video production**

*Competency Builders:*

13.4.1 Demonstrate knowledge of different types of lighting fixtures
13.4.2 Identify parts of lighting fixtures and the function of each
13.4.3 Identify various applications of stage lighting equipment
13.4.4 Demonstrate knowledge of functions of master lighting panel and dimmer board
13.4.5 Analyze/document lighting requirements for production
13.4.6 Design a standard lighting plot
13.4.7 Set up appropriate lighting for a production
13.4.8 Operate master lighting panel and dimmer board in accordance with specifications
13.4.9 Appraise maintenance needs for lighting equipment
13.4.10 Design special effects lighting

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 13.5: Design scenery for a video production**

*Competency Builders:*

13.5.1 Design scenic plans to scale
13.5.2 Interpret scenic plans to determine the materials and hardware needed for scenic construction
13.5.3 Formulate design strategies for the construction of scenery
13.5.4 Create special effects scenery
13.5.5 Select stage props
13.5.6 Organize transportation of scenery to remote locations
13.5.7 Inspect/repair scenery as needed

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 13.6: Operate video cameras**

*Competency Builders:*

13.6.1 Record under tungsten conditions (IM)
13.6.2 Record under daylight conditions (IM)
13.6.3 Record under backlight conditions (IM)
13.6.4 Record while panning (IM)
13.6.5 Record while zooming (IM)
13.6.6 Record while tilting (IM)
13.6.7 Record while simultaneously panning, tilting, and zooming with camera mounted on a tripod (IM)
13.6.8 Record while simultaneously panning, tilting, and zooming using a hand-held camera (IM)
13.6.9 Play back recording on monitor (IM)
13.6.10 Identify the effect on a video camera of changing the setting in low light levels (IM)

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 13.7: Identify video formats**

*Competency Builders:*

13.7.1 Compare/contrast consumer-, industrial-, and broadcast-grade video cameras (IM)
13.7.2 Demonstrate knowledge of the characteristics of various camera formats (e.g., Betacam, VHS, 8mm, super VHS, and DV-Cam) (IM)
13.7.3 Identify image characteristics affected by camera choice (IM)
13.7.4 Compare/contrast frame and field modes (IM)
13.7.5 Compare/contrast NTSC, PAL, and RGB video signals (IM)
13.7.6 Demonstrate knowledge of frame synchronization and time base correction (IM)

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 13.8: Perform editing operations**

*Competency Builders:*

13.8.1 Demonstrate knowledge of operational parts of a videocassette editor (IM)
13.8.2 Compare/contrast linear and nonlinear editing systems (IM)
13.8.3 Set up videocassette editor (IM)
13.8.4 Perform assemble edits (IM)
13.8.5 Perform insert edits (IM)
13.8.6 Edit using dissolves (A-B roll) (IM)
13.8.7 Add sound track (IM)
13.8.8 Add narration/voice-over (IM)
13.8.9 Interpret edit decision lists (IM)
13.8.10 Employ edit decision lists (IM)

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | IR | P |

**Competency 13.9: Digitize video**

*Competency Builders:*

13.9.1 Demonstrate knowledge of the characteristics and uses of digitized video (IM)
13.9.2 Demonstrate knowledge of digital video bandwidths and their implications (IM)
13.9.3 Digitize videotapes using a video capture card and appropriate software (IM)
13.9.4 Edit digitized video, including transitions, special effects, and computerized backgrounds (IM)
13.9.5 Compress video files (IM)
13.9.6 Employ the batch capture process (IM)

# Unit 14: Audio Production

**BIL:** Recommended – IM
**AC:** Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 14.1: Demonstrate knowledge of audio recording and sound reinforcement**

*Competency Builders:*

14.1.1 Demonstrate knowledge of basic acoustic principles and formulae
14.1.2 Demonstrate knowledge of the function and design of microphones
14.1.3 Diagram signal flow throughout the recording chain
14.1.4 Demonstrate knowledge of how to operate a mixing console, including its input and output functions
14.1.5 Demonstrate knowledge of how to edit audio recordings
14.1.6 Demonstrate knowledge of properties of analog and digital recording
14.1.7 Demonstrate knowledge of sound reinforcement techniques used for live programs
14.1.8 Demonstrate knowledge of the characteristics and applications of analog signal processing
14.1.9 Demonstrate knowledge of the characteristics and applications of digital signal processing
14.1.10 Critique recordings

**BIL:** Essential – IM
**AC:** Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 14.2: Demonstrate knowledge of audio production**

*Competency Builders:*

14.2.1 Analyze current trends in electronic music (IM)
14.2.2 Demonstrate knowledge of MIDI (IM)
14.2.3 Demonstrate knowledge of digital synthesis (IM)
14.2.4 Demonstrate knowledge of how to select computer music appropriate for a given application (IM)
14.2.5 Demonstrate knowledge of methods for compressing sound files (IM)
14.2.6 Demonstrate knowledge of digital sampling (IM)
14.2.7 Assess potential markets for electronic music (IM)
14.2.8 Demonstrate knowledge of methods of analog and digital editing (IM)
14.2.9 Demonstrate knowledge of how to use audio editors (IM)
14.2.10 Demonstrate knowledge of digital audio bandwidths and their implications (IM)

14.2.11 Demonstrate knowledge of the various computer hardware and software used in studio recording (IM)
14.2.12 Demonstrate knowledge of methods for mastering audio recordings (e.g., in the form of an audiotape, compact disk, DVD) (IM)
14.2.13 Identify future technologies predicted for audio recording (IM)

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 14.3: Create a sound track**
*Competency Builders:*
14.3.1 Evaluate performance needs
14.3.2 Evaluate technical resources
14.3.3 Analyze script information to identify sound requirements
14.3.4 Design sound score appropriate to production and post-production needs
14.3.5 Select sound material
14.3.6 Hire talent, if necessary
14.3.7 Coordinate the work of the hired talent
14.3.8 Determine microphone and speaker placement
14.3.9 Incorporate mechanical and electrical sound effects
14.3.10 Demonstrate knowledge of audio-for-video recording devices (analog, digital)
14.3.11 Set up audio-for-video recording devices
14.3.12 Operate audio-for-video recording devices
14.3.13 Demonstrate knowledge of the time-code system for audio-video synchronization
14.3.14 Set up time-code system for audio-video synchronization
14.3.15 Operate time-code system for audio-video synchronization
14.3.16 Demonstrate knowledge of the parts of an audio mixing console
14.3.17 Operate audio mixing console
14.3.18 Create a MIDI sound score

# Unit 15: Internet

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | P | | |
| NS | P | | |
| PSD | P | | |
| IM | P | | |

**Competency 15.1: Demonstrate basic knowledge of the Internet**
*Competency Builders:*
15.1.1 Identify the key characteristics of the Internet
15.1.2 Demonstrate knowledge of the ownership/administration of the Internet
15.1.3 Trace the development of Internet technology
15.1.4 Identify current issues related to the Internet
15.1.5 Identify services and tools offered on the Internet
15.1.6 Identify the specific strengths, weaknesses, and special features of available search engines
15.1.7 Demonstrate knowledge of bookmarks and their functions
15.1.8 Demonstrate knowledge of accepted Internet etiquette (netiquette)
15.1.9 Identify current uses and applications of the Internet

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |
| IM | | I | P |

**Competency 15.2: Demonstrate advanced knowledge of the Internet**
*Competency Builders:*
15.2.1 Demonstrate knowledge of the Transmission Control Protocol/Internet Protocol (TCP/IP) suite (ISS, NS, PSD, IM)
15.2.2 Demonstrate knowledge of the Domain Name Server (DNS) (ISS, NS, PSD, IM)
15.2.3 Demonstrate knowledge of Simple Network Management Protocol (SNMP)
15.2.4 Demonstrate knowledge of Bootstrap Protocol (BOOTP) and Dynamic Host Configuration Protocol (DHCP)
15.2.5 Demonstrate knowledge of the Address Resolution Protocol (ARP)
15.2.6 Demonstrate knowledge of IP forwarding, encapsulation, and fragmentation

15.2.7 Demonstrate knowledge of Internet security issues (ISS, NS, PSD, IM)
15.2.8 Identify available Internet security systems

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | P | PR | |
| NS | P | PR | |
| PSD | P | PR | |
| IM | P | PR | |

**Competency 15.3: Access the Internet**
*Competency Builders:*
15.3.1 Connect to the Internet
15.3.2 Test Internet connection
15.3.3 Demonstrate knowledge of the components of Internet software
15.3.4 Install Internet software
15.3.5 Explore browser features
15.3.6 Download free software upgrades and shareware from the Internet
15.3.7 Unpack files using compression software
15.3.8 Demonstrate acute awareness of virus protection techniques

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Science, Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | P | PR | |
| NS | P | PR | |
| PSD | P | PR | |
| IM | P | PR | |

**Competency 15.4: Utilize Internet services**
*Competency Builders:*
15.4.1 Access business and technical information using the Internet
15.4.2 Select search engine(s) to use
15.4.3 Select appropriate search procedures and approaches
15.4.4 Locate information using search engine(s) and Boolean logic
15.4.5 Navigate web sites using software functions (e.g., Forward, Back, Go To, Bookmarks)
15.4.6 Evaluate Internet resources (e.g., accuracy of information)
15.4.7 Access library catalogs on the Internet
15.4.8 Access commercial, government, and education resources

| | |
|---|---|
| 15.4.9 | Bookmark web addresses (URLs) |
| 15.4.10 | Download files from FTP archives |
| 15.4.11 | Communicate via e-mail using the Internet |
| 15.4.12 | Subscribe to mailing lists |
| 15.4.13 | Participate in newsgroups |
| 15.4.14 | Retrieve online tools |
| 15.4.15 | Download/convert Internet programming files |
| 15.4.16 | Install/configure web browser |
| 15.4.17 | Explore the multimedia capabilities of the World Wide Web |
| 15.4.18 | Add plug-ins and helpers to the web browser |
| 15.4.19 | Explore collaboration tools |
| 15.4.20 | Participate in online audio and video conferencing |
| 15.4.21 | Archive files |
| 15.4.22 | Compile a collection of business sites (e.g., finance and investment) |
| 15.4.23 | Explore electronic commerce |

# Unit 16: Web Page Design

**BIL:** Essential – ISS, PSD, IM Recommended – NS
**AC:** Mathematics, Science
**RC:** **CCNA-Curr**, MCP, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| NS | | I | |
| PSD | I | P | |
| IM | I | P | |

**Competency 16.1: Demonstrate knowledge of web page basics**
*Competency Builders:*

16.1.1 Differentiate between a client and a server
16.1.2 Demonstrate knowledge of the role of browsers in reading files on the World Wide Web (text-only, hypertext)
16.1.3 Identify how different browsers affect the look of a web page
16.1.4 Compare/contrast the features and functions of software editors available for designing web pages
16.1.5 Demonstrate knowledge of how bandwidths affect data transmission and on-screen image
16.1.6 Demonstrate knowledge of the characteristics and uses of plug-ins
16.1.7 Compare the advantages and disadvantages of running your own server vs. using a server provider

**BIL:** Essential – PSD, IM Recommended – ISS
**AC:**
**RC:** CCNA-Curr, MOUS, MCP, MCSD, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | |
| PSD | I | P | |
| IM | I | P | |

**Competency 16.2: Demonstrate knowledge of Internet programming basics**
*Competency Builders:*

16.2.1 Recognize the importance of Internet programming standards
16.2.2 Demonstrate knowledge of standard Internet programming coding
16.2.3 Demonstrate knowledge of special Internet programming feature codes (tags)
16.2.4 Differentiate between various versions of Internet programming
16.2.5 Demonstrate knowledge of how to use standard word processing and page layout programs to produce an Internet application
16.2.6 Identify authoring programs specifically designed for Internet programming production (e.g., Adobe PageMill, Corel Xara, Microsoft FrontPage)
16.2.7 Locate free Internet programming authoring programs on the Internet

16.2.8 Compare/contrast features, strengths, and weaknesses of different authoring programs
16.2.9 Identify cross-platform issues
16.2.10 Keep up-to-date with new and emerging trends related to Internet programming

**BIL:** Essential – PSD Recommended – ISS, IM
**AC:**
**RC:** **CCNA-Curr**, MCP, MCSD

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | IR |
| PSD | I | P | |
| IM | | I | P |

**Competency 16.3: Apply knowledge of basic web programming**
*Competency Builders:*
16.3.1 Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI)
16.3.2 Demonstrate knowledge of how to interface client/server
16.3.3 Demonstrate knowledge of client-side processing and its advantages/disadvantages
16.3.4 Identify security issues related to client-side processing
16.3.5 Identify standard scripting languages (e.g., JavaScript, Visual Basic Script, ActiveX)
16.3.6 Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages
16.3.7 Demonstrate knowledge of how to use a scripting language to program a site
16.3.8 Demonstrate knowledge of how to use advanced communication protocols

**BIL:** Recommended – ISS, PSD, IM
**AC:** Mathematics, Communications
**RC:** CCNA-Curr, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | IR |
| PSD | | | I |
| IM | | | I |

**Competency 16.4: Apply knowledge of web hosting**
*Competency Builders:*
16.4.1 Compare the advantages and disadvantages of running your own server vs. using a server provider
16.4.2 Identify hardware requirements for a server
16.4.3 Identify server software options
16.4.4 Evaluate server providers

16.4.5 Establish a domain name
16.4.6 Comply with TCP/IP (Transfer Control Protocol/Internet Protocol)
16.4.7 Upload files to the server
16.4.8 Publicize the site (e.g., submit announcements to major search engines)
16.4.9 Collect/analyze usage statistics

**BIL:** Essential – PSD Recommended – IM
**AC:**
**RC:** MOUS, NKC

| EDU: | 10 | 12 | AD |
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| PSD | I | P | |
| IM | | | P |

**Competency 16.5: Create/maintain a basic Internet programming document**
*Competency Builders:*
16.5.1 Open up a workspace to create a new Internet programming document
16.5.2 Create the basic Internet programming structure for a web page using a text editor
16.5.3 Demonstrate knowledge of the advantages of creating short multiple web pages rather than a single, long web page
16.5.4 Determine logical points to split information into multiple web pages
16.5.5 Create a template file using a text editor
16.5.6 Make appropriate changes to template file to create individual pages
16.5.7 Insert nondisplayed comments into Internet programming files
16.5.8 Display document within a web browser
16.5.9 Make text modifications using a text editor
16.5.10 Place different-level headings within document using appropriate Internet programming tags
16.5.11 Insert paragraph breaks into the text of document using appropriate Internet programming tag
16.5.12 Manipulate text cut and paste functions
16.5.13 Insert a stylized footer at the bottom of a page
16.5.14 Format text
16.5.15 Create lists
16.5.16 Add graphics/images
16.5.17 Add animation

**BIL:** Essential – PSD, IM Recommended – ISS
**AC:**
**RC:** MOUS, MCP, MCSD, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | IR |
| PSD | I | P | |
| IM | I | P | |

**Competency 16.6: Format page layout**
*Competency Builders:*

16.6.1 Demonstrate knowledge of Internet programming codes for formatting page layout
16.6.2 Create a solid color background
16.6.3 Calculate the hexadecimal code for a color value
16.6.4 Change the color of text and hypertext link items
16.6.5 Create a textured background using a graphic file
16.6.6 Create various types of hard rule lines for page dividers (e.g., different thicknesses and widths, with and without 3-D shading)
16.6.7 Create a table with rows and columns of text in a gridded display
16.6.8 Create a layout scheme integrating text and pictures
16.6.9 Create an invisible table with side-by-side columns
16.6.10 Create a table that has different colored cells
16.6.11 Demonstrate knowledge of interface design
16.6.12 Display interlaced images
16.6.13 Organize information using frames

**BIL:** Essential – PSD, IM Recommended – ISS
**AC:**
**RC:** NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | IR |
| PSD | | I | P |
| IM | | I | P |

**Competency 16.7: Add audio and video to a web page**
*Competency Builders:*

16.7.1 Demonstrate knowledge of how to deliver audio and video signals in real time (streaming) (PSD, IM)
16.7.2 Demonstrate knowledge of audio sweetening techniques (PSD, IM)
16.7.3 Demonstrate knowledge of audio and video compression techniques (PSD, IM)
16.7.4 Add audio and video to a web page using Internet programming codes
16.7.5 Establish network administration procedures for audio and video

**BIL:** Essential – PSD, IM Recommended – ISS
**AC:**
**RC:** **CCNA-Curr**, MOUS, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | IR |
| PSD | I | P | |
| IM | I | P | |

**Competency 16.8: Link documents**

*Competency Builders:*

16.8.1 Identify the function of URLs (Uniform Resource Locators)
16.8.2 Recognize the structure of a URL
16.8.3 Copy URLs from a web browser to an Internet programming text document
16.8.4 Write an Internet programming anchor to link to another document in the same directory as the first document
16.8.5 Write an Internet programming anchor to link to another document in a different directory from the first document
16.8.6 Write an Internet programming anchor to link to another web document on the Internet
16.8.7 Write an Internet programming anchor to link to files
16.8.8 Write an Internet programming anchor that links to another section of the same document
16.8.9 Incorporate a graphic that acts as a hyperlink to another document
16.8.10 Identify the significance of a file called *index.html* on a web server
16.8.11 Create a hypertext link that will send an e-mail message
16.8.12 Differentiate between client-side image mapping and server-side image mapping
16.8.13 Create an inline image that has different portions hyperlinked to other web pages, pictures, and other sites on the Internet
16.8.14 Create hyperlinks for the use of plug-ins

# Unit 17: Interactive Multimedia Production

**BIL:** Essential – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.1: Demonstrate knowledge of interactive media**

*Competency Builders:*

17.1.1 Demonstrate knowledge of interactive media components
17.1.2 Identify the major characteristics of interactive media presentations
17.1.3 Identify the important historical developments leading to contemporary interactive media
17.1.4 Demonstrate knowledge of various interactive media industry genres
17.1.5 Perform critical review of various interactive media end products
17.1.6 Identify rights, responsibilities, and controls related to various interactive media
17.1.7 Interpret intellectual property laws relative to interactive media
17.1.8 Analyze the social and cultural implications of interactive media
17.1.9 Identify key criticisms of interactive media
17.1.10 Identify possible markets for interactive media (e.g., sales and marketing, interactive advertising, K-12 education, corporate training, corporate communications, distance learning, news, entertainment)
17.1.11 Identify specific uses of interactive media in each potential market
17.1.12 Identify future trends in interactive media

**BIL:** Essential – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.2: Produce interactive media as a member of a development team**

*Competency Builders:*

17.2.1 Define the role of individual team members
17.2.2 Develop a conceptual model for the interactive media project
17.2.3 Select appropriate hardware tools
17.2.4 Select appropriate software tools
17.2.5 Select the media elements (e.g., sound, video, graphics, text, animation) to be used
17.2.6 Integrate media elements

17.2.7 Select the publication process to be used
17.2.8 Select the distribution method to be used
17.2.9 Justify decisions made

**BIL:** Essential – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | I | P | |

**Competency 17.3: Pursue interactive media career opportunities**
*Competency Builders:*
17.3.1 Identify potential career areas in interactive media
17.3.2 Identify components of portfolio
17.3.3 Establish criteria for portfolio components
17.3.4 Select appropriate materials/projects for inclusion in portfolio

**BIL:** Essential – IM
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.4: Develop project concept proposal**
*Competency Builders:*
17.4.1 Determine purpose of the interactive media project
17.4.2 Determine the target audience
17.4.3 Determine objectives
17.4.4 Research the content
17.4.5 Develop a design brief
17.4.6 Select appropriate message design (e.g., instructional, informational, entertainment)
17.4.7 Determine the setting where the message will be used
17.4.8 Determine the interactive media elements to be used
17.4.9 Determine degree of interactivity desired
17.4.10 Identify available media and content sources
17.4.11 Decide whether to produce or acquire content (graphics, animation, audio, video, simulations, virtual environments)
17.4.12 Develop time line for completion
17.4.13 Develop project budget
17.4.14 Write proposal

**BIL:** Essential – IM
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.5: Meet client needs**
*Competency Builders:*
17.5.1 Determine client's needs and expected outcomes
17.5.2 Prepare cost estimate for client
17.5.3 Obtain client approvals throughout project

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.6: Develop storyboards to communicate ideas**
*Competency Builders:*
17.6.1 Make preliminary sketches showing placement of images and text on screen
17.6.2 Show placement of buttons/navigational graphics
17.6.3 Provide information on color schemes
17.6.4 Provide information on lighting
17.6.5 Provide a sample screen

**BIL:** Essential – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.7: Develop flowchart/navigational blueprints**
*Competency Builders:*
17.7.1 Develop flowcharts with radial branching
17.7.2 Develop flowcharts with linear branching
17.7.3 Develop flowcharts with linking/nonlinear branching

**BIL:** Essential – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.8: Write scripts**

*Competency Builders:*

17.8.1 Describe music to be used
17.8.2 Describe video (still and motion)
17.8.3 Describe special effects (video and audio)
17.8.4 Write narration and actor lines
17.8.5 Describe scenes

**BIL:** Essential – IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | P |

**Competency 17.9: Combine media elements to produce an interactive multimedia project**

*Competency Builders:*

17.9.1 Apply visual design skills (IM)
17.9.2 Generate text for multi-image presentations (e.g., title slides, charts, graphs) (IM)
17.9.3 Create 2-D computer graphics (IM)
17.9.4 Create 3-D computer graphics (IM)
17.9.5 Create computer animation (IM)
17.9.6 Enhance interactive media presentation using a photographic process (IM)
17.9.7 Integrate the use of photographic special effects into interactive media presentations (IM)
17.9.8 Digitize photographic images for interactive media (IM)
17.9.9 Alter digitized images using an image manipulation program (IM)
17.9.10 Integrate photographically derived images with hand-drawn graphic images (IM)
17.9.11 Acquire talent, if necessary
17.9.12 Coordinate work with the acquired talent
17.9.13 Create video footage (IM)
17.9.14 Digitize/edit video footage using computer video-editing software (IM)
17.9.15 Record sound track, including narration, voice-overs, sound effects, and music (IM)
17.9.16 Integrate sound with visuals (IM)
17.9.17 Build in hotspots and interactive links (IM)
17.9.18 Synthesize available interactive media technologies into a unified presentation using appropriate authoring software (IM)

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | |

**Competency 17.10: Create interactive media applications**
*Competency Builders:*
17.10.1 Produce an interactive media presentation (e.g., web-based, local)
17.10.2 Produce computer-generated video
17.10.3 Produce a kiosk
17.10.4 Utilize video conferencing
17.10.5 Demonstrate computer-to-computer collaboration

**BIL:** Recommended – IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | P | |

**Competency 17.11: Maintain interactive media equipment**
*Competency Builders:*
17.11.1 Demonstrate knowledge of proper care and handling procedures for interactive media equipment
17.11.2 Perform pre-and post-production routines for presentations
17.11.3 Analyze equipment performance against industry standards
17.11.4 Troubleshoot simple equipment problems

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| IM | | I | |

**Competency 17.12: Test/evaluate the functionality and content of the project**
*Competency Builders:*
17.12.1 Test product
17.12.2 Debug product

# Unit 18: Hardware Design, Operation, and Maintenance

**BIL:** Essential – NS Recommended – ISS
**AC:**
**RC:** A+, CCNA, **CCNA-Curr**, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | | P | |

**Competency 18.1: Demonstrate knowledge of hardware standards**

*Competency Builders:*

18.1.1 Identify standard-setting bodies
18.1.2 Identify OSI, IEEE, ISO, and ITU-T (formerly CCITT) standards
18.1.3 Demonstrate knowledge of the importance of conformance and use of operating system APIs (rather than direct manipulation of hardware)

**BIL:** Essential – NS Recommended – ISS, IM
**AC:** Science
**RC:** A+, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | I | P | |
| IM | | | I |

**Competency 18.2: Analyze the computer site environment**

*Competency Builders:*

18.2.1 Identify environmental requirements, conditions, and limitations
18.2.2 Identify power requirements and power supplies
18.2.3 Identify ergonomic issues
18.2.4 Identify structural capacities
18.2.5 Identify electrical wiring codes

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:**
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | I | P | |
| PSD | | I | P |
| IM | | I | IR |

**Competency 18.3: Demonstrate knowledge of computer architecture and processor types**
*Competency Builders:*

18.3.1 Demonstrate knowledge of microcomputer architecture and processors (ISS)
18.3.2 Compare/contrast the features of different microcomputer processors (ISS)
18.3.3 Demonstrate knowledge of minicomputer architecture and processors (ISS)
18.3.4 Demonstrate knowledge of mainframe architecture and processors (ISS)
18.3.5 Identify internal box components (ISS)
18.3.6 Compare/contrast system bus structures (e.g., ISA, EISA, MCA, PCI, USB) (ISS)
18.3.7 Evaluate architecture alternatives (ISS)

**BIL:** Essential – PSD Recommended – ISS, NS
**AC:** Mathematics
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 18.4: Demonstrate basic knowledge of computer system architecture**
*Competency Builders:*

18.4.1 Interpret terminology and acronyms related to computer systems architecture (PSD)
18.4.2 Identify the input, process, output and storage hardware required in a system (PSD)
18.4.3 Identify the basic organization of CPU architecture (e.g., Von Neumann, block diagram, data paths, control path, functional units, instruction cycles) (PSD)
18.4.4 Demonstrate knowledge of multiprocessor architectures (e.g., single multiprocessing and distributed processing, stack, array, vector, multiprocessor, hypercube, client server, supercomputers) (PSD)
18.4.5 Demonstrate knowledge of fundamentals of instruction-set types and architectures, including registers and RISC addressing modes (PSD)
18.4.6 Demonstrate knowledge of data-structure machine representations, including signed integers, character strings, stacks, records, and linked lists (PSD)
18.4.7 Demonstrate knowledge of the principles and operation of volatile and nonvolatile memory (PSD)

18.4.8 Demonstrate knowledge of the principles and operation of advanced memory techniques (PSD)
18.4.9 Demonstrate knowledge of standard input/output devices and systems (PSD)
18.4.10 Demonstrate knowledge of the I/O subsystem
18.4.11 Demonstrate knowledge of machine-language instruction encoding (PSD)
18.4.12 Demonstrate knowledge of input/output techniques at the I/O driver level
18.4.13 Demonstrate knowledge of the principles and operation of addresses and interrupt processing (e.g., CICS) (PSD)
18.4.14 Identify low-level algorithms for conversion and data manipulation
18.4.15 Demonstrate knowledge of assembly-language-level parameter-passing techniques
18.4.16 Demonstrate knowledge of priorities and interrupts (PSD)
18.4.17 Demonstrate knowledge of direct-memory-access data-handling system(s)
18.4.18 Define functions of advanced memory techniques (e.g., virtual, pipeline, cache) (PSD)
18.4.19 Demonstrate knowledge of how commands handle tasks in operating systems (PSD)
18.4.20 Identify the purpose of operating system utilities (PSD)
18.4.21 Identify the hardware components of a digital computer (PSD)
18.4.22 Demonstrate knowledge of instruction set design
18.4.23 Demonstrate knowledge of the issues, principles, and essential building blocks in designing a processor
18.4.24 Identify cost-performance issues and design trade-offs in building a computer system

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:**
**RC:** A+, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | | | I |
| IM | | | I |

**Competency 18.5: Demonstrate knowledge of CPU components**
*Competency Builders:*
18.5.1 Demonstrate knowledge of chip configuration and structure (ISS, NS)
18.5.2 Identify the functions of internal components (ISS, NS)
18.5.3 Demonstrate knowledge of the characteristics and operation of motherboards (ISS, NS)
18.5.4 Demonstrate knowledge of the characteristics and operation of co-processor boards (e.g., math, graphics, fax, modems, voice) (ISS, NS)
18.5.5 Demonstrate knowledge of the characteristics and operation of controller cards
18.5.6 Demonstrate knowledge of the characteristics and operation of network interface cards

18.5.7 Demonstrate knowledge of the characteristics and operation of the PCMCIA bus (PC Card and CardBus)

18.5.8 Demonstrate knowledge of logic elements and switching theory, including minimization concepts and implementation of functions

18.5.9 Demonstrate knowledge of propagation delays and hazards

18.5.10 Demonstrate knowledge of the characteristics and operation of multiplexers, demultiplexers, decoders, encoders, adders, subtractors, comparators, shift registers and counters

18.5.11 Differentiate between ROM, PROM, EPROM, EEPROM, RAM

18.5.12 Differentiate between synchronous and asynchronous circuits

**BIL:** Essential – ISS, NS Recommended – PSD

**AC:**

**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| **EDU:** | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | P | |
| PSD | | | I |

**Competency 18.6: Demonstrate a basic knowledge of connectivity devices**

*Competency Builders:*

18.6.1 Demonstrate knowledge of the characteristics and operation of baluns

18.6.2 Demonstrate knowledge of the characteristics and operation of multiplexers, modems, CODECS, DSU (ISS)

18.6.3 Demonstrate knowledge of the characteristics and operation of switches, gateways, bridges, routers, brouters, and repeaters (ISS)

18.6.4 Demonstrate knowledge of the characteristics and operation of test equipment (e.g., protocol analyzers)

**BIL:** Essential – ISS Recommended – PSD
**AC:**
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | | I |

**Competency 18.7: Explain operation of microprocessor systems**
*Competency Builders:*

18.7.1 Demonstrate knowledge of the essential components of microprocessor and the functions of each
18.7.2 Demonstrate knowledge of the principles and operation of bus concepts (e.g., VESA, EISA)
18.7.3 Demonstrate knowledge of the principles and operation of different types of memory circuits
18.7.4 Demonstrate knowledge of operating systems (e.g., UNIX, Windows, Windows NT, MVS)
18.7.5 Demonstrate knowledge of microprocessor instruction sets
18.7.6 Demonstrate knowledge of the principles and operation of microprocessor machine code
18.7.7 Demonstrate knowledge of types of input and output devices and peripherals
18.7.8 Demonstrate knowledge of the principles and operation of storage devices
18.7.9 Connect input and output ports to peripherals
18.7.10 Demonstrate knowledge of central processing unit building blocks and their uses

**BIL:** Essential – ISS Recommended – PSD, IM
**AC:**
**RC:** A+, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | I | P |
| IM | | I | P |

**Competency 18.8: Demonstrate knowledge of peripheral equipment**
*Competency Builders:*

18.8.1 Demonstrate knowledge of peripheral I/O and interrupts
18.8.2 Demonstrate knowledge of I/O control methods
18.8.3 Demonstrate knowledge of external storage concepts, physical organization, and drives
18.8.4 Demonstrate knowledge of the characteristics and functions of optical auxiliary storage
18.8.5 Demonstrate knowledge of storage space allocation hierarchies
18.8.6 Demonstrate knowledge of main memory organization, bus operations, and cycle times for selection and addressing

18.8.7 Demonstrate knowledge of the characteristics and functions of read/write and cache memory
18.8.8 Demonstrate knowledge of the characteristics and functions of virtual memory
18.8.9 Identify interfaces between computers and other devices
18.8.10 Define printer types and related interface controllers
18.8.11 Demonstrate knowledge of the operation of typical magnetic tape equipment and interface controllers
18.8.12 Demonstrate knowledge of disk equipment and related interface controllers
18.8.13 Define environmental requirements for peripherals and media

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:** CCNA, CCNA-Curr

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | | I |

**Competency 18.9: Design computer systems**

*Competency Builders:*

18.9.1 Develop detailed design and interface specifications
18.9.2 Design human factor interface
18.9.3 Identify system platform, components, and dependencies
18.9.4 Break down subsystems
18.9.5 Develop physical data model
18.9.6 Participate in peer and formal design reviews (including validation)
18.9.7 Identify maintenance requirements
18.9.8 Create prototypes
18.9.9 Review/critique user documentation
18.9.10 Write/document code
18.9.11 Perform unit testing
18.9.12 Analyze errors
18.9.13 Resolve errors
18.9.14 Integrate subsystems
18.9.15 Update detailed design and interface specifications
18.9.16 Participate in peer code review
18.9.17 Demonstrate knowledge of how to specify major subsystems and interfaces
18.9.18 Demonstrate knowledge of how to select design methodology
18.9.19 Demonstrate knowledge of how to select design tools
18.9.20 Demonstrate knowledge of how to develop models (e.g., business, physical interface, logical data)
18.9.21 Demonstrate knowledge of how to validate architecture and models

**BIL:** Essential – ISS Recommended – PSD, IM
**AC:** Communications
**RC:** A+, **CCNA, CCNA-Curr**, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | I | P | |
| IM | | I | P |

**Competency 18.10: Install computer system (e.g., monitor, keyboard, disk drive, and printer)**

*Competency Builders:*

18.10.1 Identify primary PC components and the functions of each (ISS)
18.10.2 Demonstrate knowledge of how hardware components interact and how conflicts arise (ISS)
18.10.3 Access needed information using manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts) (ISS)
18.10.4 Secure supplies and resources
18.10.5 Respond to error messages and symptoms of hardware failures
18.10.6 Install boards to support peripherals
18.10.7 Connect peripherals to CPU
18.10.8 Employ appropriate safety precautions when working with PCs (ISS)
18.10.9 Configure system
18.10.10 Verify system operation
18.10.11 Document system installation activities
18.10.12 Backup system configuration
18.10.13 Test all applications

**BIL:** Essential – ISS Recommended – PSD, IM
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | | I | P |
| IM | | I | P |

**Competency 18.11: Troubleshoot computer systems**

*Competency Builders:*

18.11.1 Identify priorities and interrupts at system level
18.11.2 Demonstrate the use of volatile and nonvolatile memory
18.11.3 Repair/replace volatile and nonvolatile memory
18.11.4 Test system using diagnostic tools/software
18.11.5 Identify problems in the operating system and related hardware (ISS)
18.11.6 Differentiate between hardware and software failure (ISS)
18.11.7 Update flash memory (BIOS)
18.11.8 Optimize hard drive (ISS)

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| 18.11.9 | Gather information on problem from user (ISS) |
| 18.11.10 | Conduct appropriate diagnostic tests (ISS) |
| 18.11.11 | Repair/replace malfunctioning hardware |
| 18.11.12 | Reinstall software as needed |
| 18.11.13 | Recover data and/or files |
| 18.11.14 | Restore system to normal operating standards |

# Unit 19: Operating Systems

**BIL:** Essential – ISS, PSD Recommended – NS
**AC:**
**RC:** A+, **CCNA-Curr**, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | I | P | |
| NS | I | P | |
| PSD | I | P | |

**Competency 19.1: Describe system components**
*Competency Builders:*

19.1.1 Demonstrate knowledge of central processing unit (CPU) control and architecture
19.1.2 Demonstrate knowledge of operating system architecture types
19.1.3 Identify operating system goals
19.1.4 Demonstrate knowledge of operating system structuring methods, layered models, and the object-server model
19.1.5 Differentiate between microcomputer, minicomputer, and mainframe operating systems
19.1.6 Demonstrate knowledge of network operating systems
19.1.7 Define the role of memory management in an operating system
19.1.8 Demonstrate knowledge of the basics of process management
19.1.9 Demonstrate knowledge of the commands used to handle tasks in operating systems
19.1.10 Demonstrate knowledge of the system utilities used for file management
19.1.11 Differentiate between a compiler and an interpreter
19.1.12 Demonstrate knowledge of interface theory in an operating system

**BIL:** Essential – ISS, PSD Recommended – NS
**AC:**
**RC:** **A+, CCNA, CCNA-Curr**, MCP, MCSE, MCSD, MCDBA, CNA, CNE

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | I | IR |
| PSD | | I | P |

**Competency 19.2: Demonstrate knowledge of computer memory**
*Competency Builders:*

19.2.1 Differentiate between memory types for PCs, mainframes, minicomputers, and networks (ISS, PSD)
19.2.2 Differentiate between the functions of extended memory, expanded memory, and cache memory (ISS, PSD)
19.2.3 Demonstrate knowledge of the role of the relationship between memory and software applications (ISS, PSD)

19.2.4 Demonstrate knowledge of memory management functions (e.g., contiguous allocation, paging, segmentation, virtual memory) (ISS, PSD)
19.2.5 Demonstrate knowledge of the role of physical memory and registers (ISS)
19.2.6 Demonstrate knowledge of the role of overlays, swapping, partitions (ISS, PSD)
19.2.7 Demonstrate knowledge of the role of pages and segments (ISS)
19.2.8 Demonstrate knowledge of the role of free lists, layout, servers, interrupts, recovery from failures (ISS)

**BIL:** Essential – ISS, NS, PSD
**AC:**
**RC:** A+, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | I | P | |

**Competency 19.3: Demonstrate knowledge of auxiliary storage**
*Competency Builders:*
19.3.1 Demonstrate knowledge of operational characteristics of storage media (ISS, NS)
19.3.2 Identify capacities of storage media (ISS, NS)
19.3.3 Demonstrate knowledge of retrieval methods for storage media (ISS, NS)
19.3.4 Differentiate between files and directories (ISS, NS)
19.3.5 Differentiate between types of storage devices (e.g., disk, tape, CD-ROM) (ISS, NS)
19.3.6 Demonstrate knowledge of mirroring and RAID concepts
19.3.7 Select storage management software to accommodate storage needs
19.3.8 Select auxiliary storage media
19.3.9 Demonstrate knowledge of compression techniques (e.g., data, image, video, audio)

**BIL:** Essential – ISS, PSD Recommended – NS
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 19.4: Maintain security requirements**
*Competency Builders:*
19.4.1 Implement security procedures in accordance with business ethics (ISS, PSD)
19.4.2 Ensure compliance with security rules, regulations, and codes (ISS, PSD)
19.4.3 Maximize threat reduction

19.4.4 Assess exposure to security issues
19.4.5 Implement countermeasures
19.4.6 Maintain confidentiality (ISS, PSD)
19.4.7 Load virus detection and protection software (ISS, PSD)
19.4.8 Identify sources of virus infections (ISS, PSD)
19.4.9 Remove viruses (ISS, PSD)
19.4.10 Report viruses in compliance with company standards
19.4.11 Implement backup and recovery procedures (ISS, PSD)
19.4.12 Demonstrate knowledge of potential internal and external threats to security (ISS, PSD)
19.4.13 Follow disaster plan (ISS, PSD)
19.4.14 Provide for user authentication (e.g., assign passwords, access level)
19.4.15 Demonstrate knowledge of virus protection strategy
19.4.16 Document security procedures

**BIL:** Essential – ISS, NS, PSD
**AC:** Communications
**RC:** A+, **CCNA**, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | I | IR | P |

**Competency 19.5: Operate system**
*Competency Builders:*
19.5.1 Apply basic commands of operating system software (ISS, NS, PSD)
19.5.2 Apply appropriate file and disk management techniques (ISS, NS, PSD)
19.5.3 Employ desktop operating skills (ISS, NS, PSD)
19.5.4 Handle materials and equipment in a responsible manner (ISS, NS, PSD)
19.5.5 Secure needed supplies and resources (ISS, NS, PSD)
19.5.6 Access needed information using appropriate reference materials (ISS, NS, PSD)
19.5.7 Review automated scheduling software (ISS, NS, PSD)
19.5.8 Identify data requirements (ISS, NS, PSD)
19.5.9 Follow power-up and log-on procedures (ISS, NS, PSD)
19.5.10 Interact with/respond to system messages using console device (ISS, NS, PSD)
19.5.11 Run applications/jobs in accordance with processing procedures (ISS, NS, PSD)
19.5.12 Identify scheduling priority in programming
19.5.13 Develop audit trails
19.5.14 Build system software command structures using operating system macro facilities for computer systems
19.5.15 Follow log-off and power-down procedure(s) (ISS, NS, PSD)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Communications
**RC:** A+, **CCNA**, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 19.6: Maintain system**
*Competency Builders:*

19.6.1 Access needed information using appropriate reference materials (ISS, NS)
19.6.2 Handle materials and equipment in a responsible manner (ISS, NS)
19.6.3 Monitor system status and performance (ISS, NS)
19.6.4 Run diagnostics (ISS, NS)
19.6.5 Respond to system messages (ISS, NS)
19.6.6 Document computer system malfunction(s) (ISS, NS)
19.6.7 Document software malfunction(s) (ISS, NS)
19.6.8 Fix recoverable problems
19.6.9 Perform preventive maintenance procedures on computer and peripheral devices
19.6.10 Install software packages
19.6.11 Restore system
19.6.12 Optimize windows environment to maximize performance of desktop resources
19.6.13 Review automated scheduling software
19.6.14 Create and use logical files
19.6.15 Create a query to extract information from a file
19.6.16 Create a query to extract information from multiple files
19.6.17 Create reports from queries
19.6.18 Develop a display screen for use with a high-level language program

**BIL:** Essential – ISS, NS, PSD
**AC:** Communications
**RC:** A+, MCP, MCSE, MCDBA, CNA, CNE

| EDU: | 10 | 12 | AD |
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| ISS | I | P | PR |
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| PSD | I | P | |

**Competency 19.7: Perform standard computer backup procedures**
*Competency Builders:*

19.7.1 Recognize the need for regular backup procedures (NS)
19.7.2 Develop backup process (NS)
19.7.3 Load backup software
19.7.4 Perform restore operation using backup software
19.7.5 Load compression drive backup software
19.7.6 Perform restore operation using compression drive backup software

19.7.7 Identify battery backup equipment (NS)
19.7.8 Maintain battery backup system
19.7.9 Install surge suppression protection

**BIL:** Essential – ISS, NS, PSD
**AC:** Communications
**RC:** A+, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | I | IR | P |
| PSD | I | IR | P |

**Competency 19.8: Provide support and training**
*Competency Builders:*
19.8.1 Operate help desk (NS, PSD)
19.8.2 Employ desktop productivity tools (NS, PSD)
19.8.3 Support computer users (NS, PSD)
19.8.4 Train computer users (NS, PSD)
19.8.5 Support Network Operating Center (NOC) (NS, PSD)

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:**
**RC:** A+, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | P | |
| PSD | | I | P |

**Competency 19.9: Employ computer system interfaces**
*Competency Builders:*
19.9.1 Define hardware-software interface issues for a computer system (ISS)
19.9.2 Identify standards and issues related to I/O programming and design of I/O interfaces
19.9.3 Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures)
19.9.4 Apply concepts of privileged instructions and protected mode programming
19.9.5 Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network) (ISS)
19.9.6 Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats)
19.9.7 Identify CPU modes of operations (ISS)
19.9.8 Allocate disk space, nonsharable resources, and I/O devices

**BIL:** Recommended – ISS, PSD
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 19.10: Demonstrate knowledge of advanced operating system concepts and mechanisms**

*Competency Builders:*

19.10.1 Identify techniques and language primitives for process synchronization

19.10.2 Identify techniques and algorithms for deadlock-handling and distributed mutual exclusion

19.10.3 Identify techniques and distributed algorithms for fault-tolerance and concurrency control

19.10.4 Demonstrate knowledge of concepts of distributed time and space

19.10.5 Identify correctness proofs for concurrent systems

19.10.6 Demonstrate knowledge of how to create, compile and test a control language program

# Unit 20: Networking

**BIL:** Essential – ISS, NS
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | PR |
| NS | | P | |

**Competency 20.1: Demonstrate knowledge of basic network classifications and topologies**

*Competency Builders:*

20.1.1 Interpret basic networking terminology
20.1.2 Differentiate between LANs, MANs and WANs
20.1.3 Demonstrate knowledge of how to turn LANs into MANs and WANs
20.1.4 Identify the basic point-to-point network topologies (e.g., star, ring, tree, network, irregular)
20.1.5 Demonstrate knowledge of packet-switching techniques
20.1.6 Identify the basic broadcast topologies (e.g., star ring, bus)
20.1.7 Demonstrate knowledge of the characteristics of connection-oriented and connectionless networks
20.1.8 Identify standard high-speed networks (e.g., broadband, ISDN, SMDS, ATM, FDDI)
20.1.9 Identify emerging networks (e.g., ATM; ISDN; satellite nets; optic nets; integrated voice, data, and video)

**BIL:** Essential – ISS, NS
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
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**Competency 20.2: Demonstrate knowledge of local-area network (LAN) trends and issues**

*Competency Builders:*

20.2.1 Demonstrate knowledge of the reasons for installing a network
20.2.2 Trace the evolution of networks
20.2.3 Analyze current trends and developments in LANs

**BIL:** Essential – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | P | |

**Competency 20.3: Demonstrate knowledge of common network computing platforms**

*Competency Builders:*

20.3.1 Differentiate between personal computers and workstations (ISS)
20.3.2 Identify the basic features of standard microprocessors (e.g., Intel family, RISC, Cyrix) (ISS)
20.3.3 Identify standard memory types (e.g., RAM, ROM, PROM, EPROM, EEPROM) (ISS)
20.3.4 Identify standard input/output devices (e.g., ISA, EISA, Micro Channel, PCI, universal serial bus, drive controllers, SCSI and SCSI 2, PCMCIA, firewire) (ISS)
20.3.5 Identify the basic features of standard operating systems (e.g., Windows 3.1, 95, 98, CE, Workgroups, NT; OS/2; Macintosh OS; Solaris) (ISS)
20.3.6 Identify the basic features of standard workstation processors
20.3.7 Identify standard CPU architectures for mid-range computers
20.3.8 Identify standard operating system software for mid-range computers (ISS)
20.3.9 Identify basic mainframe capabilities (ISS)
20.3.10 Identify basic mainframe attributes (e.g., size, system capacity, processor speeds, fault tolerance, security, transaction processing) (ISS)
20.3.11 Identify common mainframe vendors (e.g., IBM, Amdahl, Hitachi Data Systems, Digital) (ISS)

**BIL:** Essential – ISS, NS
**AC:** Mathematics, Science
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
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**Competency 20.4: Demonstrate knowledge of LAN physical media**

*Competency Builders:*

20.4.1 Differentiate between baseband and broadband transmission (ISS)
20.4.2 Demonstrate knowledge of Manchester encoding
20.4.3 Identify the criteria used in making cable selection decisions (e.g., physical properties, transmission technologies, transmission span, bandwidth, topology, security, noise immunity, installation considerations, cost)
20.4.4 Demonstrate knowledge of cable types (e.g., coaxial, twisted-pair, optical fibers) (ISS)
20.4.5 Compare/contrast a cable types
20.4.6 Demonstrate knowledge of types of cable connectors and grounding techniques
20.4.7 Demonstrate knowledge of typical cable applications
20.4.8 Demonstrate knowledge of cable standards (e.g., ANSI, EIA/TIA-568, EIA/TIA-569, TWSS, NEC)
20.4.9 Identify the advantages and disadvantages of LAN cabling systems
20.4.10 Demonstrate knowledge of LAN system physical layouts
20.4.11 Demonstrate knowledge of how to conduct cable installation site survey
20.4.12 Demonstrate knowledge of how to estimate cable and components required based on installation site survey results
20.4.13 Demonstrate knowledge of checks that need to be made prior to installing cable
20.4.14 Demonstrate knowledge of the documentation and labeling needed when installing cable
20.4.15 Demonstrate knowledge of accepted methods for installing cable
20.4.16 Demonstrate knowledge of typical problems associated with cable installation
20.4.17 Demonstrate knowledge of cable testing and tolerance levels
20.4.18 Demonstrate knowledge of possible sources of interference and methods for overcoming each
20.4.19 Demonstrate knowledge of basic cabling schemes and alternatives

**BIL:** Essential – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
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**Competency 20.5: Demonstrate knowledge of network connectivity basics**

*Competency Builders:*

20.5.1 Demonstrate knowledge of the characteristics and functions of point-to-point channels, switched, and meshed network (ISS)

20.5.2 Demonstrate knowledge of the characteristics and functions of broadcast channels (ISS)

20.5.3 Identify software used to connect networking devices (ISS)

20.5.4 Demonstrate knowledge of types of interoperability (e.g., peer-to-peer, peer-to-host) (ISS)

20.5.5 Demonstrate knowledge of Internet, Intranet, and Extranet usage and connectivity (ISS)

**BIL:** Essential – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 20.6: Differentiate processes, services, and protocols**

*Competency Builders:*

20.6.1 Demonstrate knowledge of protocol concepts (e.g., converters, basic layering concepts, peer communication, routing, stacks/suites) (NS)

20.6.2 Differentiate between a process and a protocol (NS)

20.6.3 Demonstrate knowledge of standard types of cooperative processes (e.g., peer-to-peer, client server, master-slave) (NS)

20.6.4 Identify the advantages and disadvantages of standard protocols (NS)

20.6.5 Demonstrate knowledge of the purposes of, and procedures for, encapsulation and decapsulation (NS)

20.6.6 Demonstrate knowledge of network address protocols (e.g., frame, packet, process) (NS)

**BIL:** Essential – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 20.7: Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498)**

*Competency Builders:*

20.7.1 Identify the benefits of using a layered network model (NS)
20.7.2 Identify the seven layers at which decisions must be made according to the OSI standard (NS)
20.7.3 Demonstrate knowledge of OSI stack positions and their relationship to one another (NS)
20.7.4 Demonstrate knowledge of the decisions to be made in the OSI physical layer (Layer 1) (NS)
20.7.5 Demonstrate knowledge of the decisions to be made in the OSI data link layer (Layer 2) (NS)
20.7.6 Demonstrate knowledge of the decisions to be made in the OSI network layer (Layer 3) (NS)
20.7.7 Demonstrate knowledge of the decisions to be made in the OSI transport layer (Layer 4) (NS)
20.7.8 Differentiate between how OSI Layers 1-4 and Layers 5-7 (NS)
20.7.9 Demonstrate knowledge of the decisions to be made in the OSI session layer (Layer 5) (NS)
20.7.10 Demonstrate knowledge of the decisions to be made in the OSI presentation layer (Layer 6) (NS)
20.7.11 Demonstrate knowledge of the decisions to be made in the OSI application layer (Layer 7) (NS)

**BIL:** Essential – ISS, NS
**AC:** Mathematics
**RC:** A+, CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 20.8: Demonstrate knowledge of communication standards for networks**

*Competency Builders:*

20.8.1 Demonstrate knowledge of digital data communication techniques and standards, including asynchronous and synchronous transmission, error detection and correction codes, and physical interfaces (e.g., RS-232, RS-422) (NS)
20.8.2 Identify software standards for subnet, presentation layers, and file servers (NS)
20.8.3 Demonstrate knowledge of data-transmission basics (NS)

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| 20.8.4 | Demonstrate knowledge of data-encoding basics (NS) |
| 20.8.5 | Demonstrate knowledge of the binary numbering system (NS) |
| 20.8.6 | Demonstrate knowledge of the hexidecimal system (NS) |
| 20.8.7 | Convert binary numbers to decimal equivalents and vice versa (NS) |
| 20.8.8 | Demonstrate knowledge of the ASCII representation of characters (NS) |
| 20.8.9 | Demonstrate knowledge of the EBCDIC representation of characters (NS) |
| 20.8.10 | Convert ASCII characters to EBCDIC equivalents and vice versa (NS) |

# Unit 21: Network Architectures

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics, Science
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 21.1: Demonstrate knowledge of the basics of network architecture**
*Competency Builders:*

21.1.1 Demonstrate knowledge of the characteristics and uses of network components (e.g., hub, switches, routers, firewall)
21.1.2 Identify LAN transmission methods (e.g., bus, pure ring, star ring topologies)
21.1.3 Demonstrate knowledge of broadband and baseband transmission methods and standards
21.1.4 Demonstrate knowledge of LAN transmission logic
21.1.5 Identify LAN transmission media (e.g., twisted pair, fiber-optic cable, wireless)
21.1.6 Demonstrate knowledge of LAN medium-access protocols (e.g., CSMA/CD, token bus, token ring, FDDI)
21.1.7 Identify the components of, and relationships within, the OSI 8802 (IEEE 802) protocol suite
21.1.8 Demonstrate knowledge of LAN protocol issues with medium-access control and data communications protocol
21.1.9 Identify LAN performance factors (signal attenuation, signal propagation delay)
21.1.10 Compare/contrast various frame formats for LANs
21.1.11 Demonstrate knowledge of frame types (e.g., SNS<802.3, 802.5)
21.1.12 Demonstrate a basic knowledge of OSI modelling
21.1.13 Differentiate between a physical and logical topology

**BIL:** Recommended – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | | I | IR |

**Competency 21.2: Demonstrate knowledge of the basics of Ethernet technology**
*Competency Builders:*

21.2.1 Demonstrate knowledge of available Ethernet topology
21.2.2 Demonstrate knowledge of the Ethernet media-access algorithm

21.2.3 Demonstrate knowledge of basic Ethernet configurations (e.g., simple, hub, hubs and bridges, server, switch)

21.2.4 Evaluate the advantages and disadvantages of an Ethernet network

**BIL:** Recommended – ISS, NS

**AC:**

**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
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**Competency 21.3: Demonstrate knowledge of the basics of token ring technology**

*Competency Builders:*

21.3.1 Demonstrate knowledge of the characteristics of a token ring network

21.3.2 Demonstrate knowledge of token ring information-flow/media-access control

21.3.3 Demonstrate knowledge of the token ring send algorithm

21.3.4 Identify token ring configurations (simple, IBM host)

21.3.5 Evaluate the advantages and disadvantages of a token ring network

**BIL:** Recommended – ISS

**AC:**

**RC:** A+, CCNA, CCNA-Curr, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 21.4: Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology**

*Competency Builders:*

21.4.1 Identify token bus configuration

21.4.2 Evaluate token bus advantages and disadvantages

21.4.3 Demonstrate knowledge of Fiber Distributed-Data Interface (FDDI) technology

21.4.4 Identify the key components of wireless LAN technology (e.g., spread-spectrum radio, infrared light, narrow-band radio)

21.4.5 Evaluate the advantages and disadvantages of a wireless LAN

**BIL:** Essential – ISS, NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 21.5: Demonstrate knowledge of the TCP/IP protocol**

*Competency Builders:*

21.5.1 Demonstrate knowledge of the basics of TCP/IP layers, components, and functions (NS)
21.5.2 Identify how the TCP layers relate to the OSI model (NS)
21.5.3 Demonstrate knowledge of the TCP and IP delivery service (NS)
21.5.4 Identify TCP/IP applications and services (e.g., rlogin, SMTP, telnet, FTP, Domain, NFS) (NS)
21.5.5 Demonstrate knowledge of TCP/IP protocol details (e.g., Internet addresses, dotted decimal notation, ARP, RARP, IP datagram format, routing IP datagrams, TCP segment format) (NS)
21.5.6 Identify the services provided by the major TCP/IP applications (NS)

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:** Mathematics
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 21.6: Demonstrate knowledge of basic communication protocols**

*Competency Builders:*

21.6.1 Demonstrate knowledge of ARPANET, MILNET and NSFnet and their relationship to the Internet
21.6.2 Demonstrate knowledge of how names and addresses are determined for LANs
21.6.3 Identify components of a Class B Internet address in dotted decimal form
21.6.4 Demonstrate knowledge of the form of a hierarchical Internet name
21.6.5 Differentiate between an ordinary and gateway node
21.6.6 Demonstrate knowledge of the IPX/SPX protocol and how it works together with TCP/IP
21.6.7 Identify the basics of the ARP/RARP protocol
21.6.8 Identify the contents of the Address Resolution Protocol (ARP) cache
21.6.9 Identify the basics of the DNS, HTTP, telnet, and FTP protocols
21.6.10 Identify the basics of the Simple Network Management Protocol (SNMP)
21.6.11 Compare/contrast SNMP functions to the OSI model
21.6.12 Identify the basics of the PAP and CHAP protocols

21.6.13 Identify the basics of MAC layer protocols
21.6.14 Identify the levels at which networking can occur
21.6.15 Differentiate between architectures (e.g., ISO, SNA, DNA)

**BIL:** Recommended – NS
**AC:**
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | | P | |

**Competency 21.7: Install basic system architectures using current Windows operating system software**

*Competency Builders:*
21.7.1 Configure a client desktop for network communications in Windows
21.7.2 Share files between two computers on a network using Windows
21.7.3 Design a system to direct cable-connect two computers using Windows
21.7.4 Expand PC memory

# Unit 22: Network Operating Systems

**BIL:** Essential – ISS, NS, PSD
**AC:** Mathematics
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

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**Competency 22.1: Demonstrate knowledge of the general characteristics of network operating systems**

*Competency Builders:*

22.1.1 Identify the purposes of a network operating system (NOS) (NS, PSD)
22.1.2 Differentiate between network operating systems and data distribution systems (NS, PSD)
22.1.3 Identify how the four components of a network operating system (i.e., server platform, network services software, network redirection software, communications software) support network operations (NS, PSD)
22.1.4 Define the criteria used to evaluate network operating systems (NS, PSD)
22.1.5 Identify how protocols are supported (NS, PSD)
22.1.6 Identify licensing requirements (NS, PSD)
22.1.7 Demonstrate knowledge of the characteristics of the client/server models (NS, PSD)
22.1.8 Analyze the advantages and disadvantages of the client/server model (NS, PSD)
22.1.9 Demonstrate knowledge of a typical program function call (NS, PSD)
22.1.10 Identify the properties of open systems (NS, PSD)
22.1.11 Demonstrate knowledge of LAN connectivity issues (NS, PSD)

**BIL:** Essential – ISS, NS, PSD
**AC:**
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 22.2: Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk)**

*Competency Builders:*

22.2.1 Identify network architecture (NS, PSD)
22.2.2 Differentiate between network systems and OSI (NS, PSD)
22.2.3 Identify capabilities of network systems (NS, PSD)
22.2.4 Demonstrate knowledge of network support systems (NS, PSD)

22.2.5 Demonstrate knowledge of protocols (NS, PSD)
22.2.6 Identify network models (NS, PSD)
22.2.7 Identify unique network tools (NS, PSD)
22.2.8 Demonstrate knowledge of network software (NS, PSD)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:**
**RC:** MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 22.3: Install network system**
*Competency Builders:*
22.3.1 Create domain trusts (ISS, NS)
22.3.2 Maintain domain controllers (ISS, NS)
22.3.3 Make policy changes (ISS, NS)
22.3.4 Employ policy templates (ISS, NS)
22.3.5 Create user accounts, groups, and login scripts (ISS, NS)
22.3.6 Control access to files and directories (ISS, NS)
22.3.7 Establish shared network resources (ISS, NS)
22.3.8 Configure network domain accounts and profiles (ISS, NS)
22.3.9 Implement system policies (ISS, NS)
22.3.10 Create roaming user profiles (ISS, NS)
22.3.11 Troubleshoot network performance (ISS, NS)

# Unit 23: Wide-Area Networks

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:**
**RC:** CCNA, CCNA-Curr, CNE, NKC

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| PSD | | I | P |
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**Competency 23.1: Demonstrate knowledge of basic telecommunications and the interconnection of networks**

*Competency Builders:*

23.1.1 Demonstrate knowledge of WAN technology (e.g., subrate facilities, dataphone, digital service, multiplexers, time division multiplexing, modems, RS-232)
23.1.2 Demonstrate knowledge of the different types of WAN connections
23.1.3 Demonstrate knowledge of point-to-point (PPP) interconnection
23.1.4 Identify basic telecommunications services (e.g., satellite, circuit switching, packet switching, wireless)
23.1.5 Differentiate between local exchange carriers (LECs) and interexchange carriers (IXCs or IECs)
23.1.6 Define local access and transport areas (LATAs)
23.1.7 Identify long-distance carriers and their services
23.1.8 Identify packet carriers and their services
23.1.9 Identify the role of telecommunications tariffs

**BIL:** Recommended – ISS, NS, PSD
**AC:**
**RC:** CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 23.2: Assess user needs for a wide-area network (WAN)**

*Competency Builders:*

23.2.1 Determine availability from LAN to meet requirements of WAN
23.2.2 Determine the speed needed between sites to access applications
23.2.3 Determine the subsets needed on the WAN
23.2.4 Evaluate transmission options

**BIL:** Recommended – ISS, NS, PSD
**AC:** Mathematics, Communications
**RC:** CCNA, CCNA-Curr, MCP, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| NS | | I | P |
| PSD | | | P |

**Competency 23.3: Design WAN systems**

*Competency Builders:*

23.3.1 Demonstrate knowledge of electronic communication (e.g., LAN, Internets, remote database access, EDI)
23.3.2 Demonstrate knowledge of basic telephony (analog vs. digital signals)
23.3.3 Demonstrate knowledge of the conversion of analog speech to digital
23.3.4 Investigate emerging technologies
23.3.5 Relate voice, data concepts, and video to wide-area networks
23.3.6 Select primary and backup data circuits
23.3.7 Evaluate analog and digital transmission for cost, performance, and reliability
23.3.8 Create firewalls between trusted network and WAN
23.3.9 Establish a Virtual Private Network (VPN) to form the infrastructure of the WAN
23.3.10 Determine routers needed to connect with LAN
23.3.11 Interconnect LANs using WAN services
23.3.12 Incorporate cost-savings approaches, including frame-relay ATM and voice/video/data compression

# Unit 24: Network Management

**BIL:** Essential – ISS, NS
**AC:** Mathematics, Communications
**RC:** **CCNA**, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 24.1: Demonstrate knowledge of network management activities and procedures**

*Competency Builders:*

24.1.1 Demonstrate knowledge of the basic principles of network management (NS)
24.1.2 Identify network system bootstrapping/initial program load (NS)
24.1.3 Identify system generation (NS)
24.1.4 Identify server configuration (NS)
24.1.5 Identify workstations (NS)
24.1.6 Demonstrate knowledge of connectivity, protocol, and security issues (NS)
24.1.7 Determine file organization (e.g., by owners, users, and privileges) (NS)
24.1.8 Establish common standards for setting up and naming files (NS)
24.1.9 Identify the criteria used to establish a hierarchical directory (NS)
24.1.10 Determine methods for increasing performance (NS)
24.1.11 Define the role of the network manager (NS)
24.1.12 Determine methods for segmenting and balancing the network load (NS)
24.1.13 Determine number of servers needed (NS)
24.1.14 Identify potential channel and cable bottlenecks and methods for resolving them (NS)
24.1.15 Determine procedures for performance analysis, evaluation, and monitoring (NS)
24.1.16 Determine procedures for network system optimization and tuning (NS)
24.1.17 Determine procedures for adding or deleting users (NS)

**BIL:** Essential – ISS, NS
**AC:** Communications
**RC:** MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | I | P |

**Competency 24.2: Demonstrate knowledge of network applications**

*Competency Builders:*

24.2.1 Demonstrate knowledge of how disk storage is shared across a network (ISS, NS)

24.2.2 Demonstrate knowledge of how processing power is shared across a network (ISS, NS)

24.2.3 Demonstrate knowledge of application-specific servers (e.g., database, print, communications, terminal, fax, security) (ISS, NS)

24.2.4 Identify the advantages of sharing backup and management of PCs across a network (ISS, NS)

24.2.5 Identify software licensing requirements and categories (ISS, NS)

**BIL:** Essential – ISS, NS
**AC:**
**RC:** MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | | I | P |

**Competency 24.3: Solve network applications problems**

*Competency Builders:*

24.3.1 Identify potential hardware compatibility problems (NS)

24.3.2 Identify precautions included in programs used on networks (e.g., self-metering, security keys, required configuration settings) (NS)

24.3.3 Identify network areas in which application problems could exist (e.g., memory allocation, file lock settings, resource availability) (NS)

24.3.4 Troubleshoot software problems (NS)

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Communications
**RC:** CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
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**Competency 24.4: Perform network analysis, selection, and design**

*Competency Builders:*

24.4.1 Gather data to identify customer requirements
24.4.2 Identify system and network requirements
24.4.3 Analyze requirements
24.4.4 Define scope of work to meet customer requirements
24.4.5 Develop functional requirements/specifications for high-level systems
24.4.6 Identify time, technology, and resource constraints
24.4.7 Identify physical requirements for system implementation
24.4.8 Analyze system interdependencies
24.4.9 Identify alternate solutions
24.4.10 Research product and vendor architecture and equipment specifications/limitations
24.4.11 Estimate impact of change request
24.4.12 Prepare cost/benefit/risk analysis
24.4.13 Perform human factors analysis
24.4.14 Participate in design reviews
24.4.15 Design prototype of system
24.4.16 Develop testing strategy
24.4.17 Prepare overall plan for integrating new processes, protocols, and equipment
24.4.18 Develop deployment strategies appropriate for situation
24.4.19 Analyze facilities' bandwidth requirements and capacity planning (power cable/wire conduit)
24.4.20 Revise processes/structure based on testing and certification
24.4.21 Identify hardware/software selection criteria
24.4.22 Select a LAN/WAN technology that meets defined set of requirements

**BIL:** Recommended – ISS, NS
**AC:**
**RC:** CCNA, CCNA-Curr, MCP, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | IR |
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**Competency 24.5: Design network security systems**

*Competency Builders:*

24.5.1 Identify need for data protection
24.5.2 Identify need for network security
24.5.3 Analyze network security issues
24.5.4 Identify security requirements
24.5.5 Analyze the advantages/disadvantages of firewall architectures
24.5.6 Select firewalls and firewall architectures (e.g., combined firewall routers, proxy server software solutions, dedicated software solutions, dedicated appliances)
24.5.7 Identify specific access levels that need to be accommodated
24.5.8 Determine how to protect against spoofing
24.5.9 Devise account administration functions to support network security
24.5.10 Develop security plans
24.5.11 Match security system design to identified security requirements

**BIL:** Essential – ISS, NS
**AC:** Communications
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
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**Competency 24.6: Perform network installation procedures**

*Competency Builders:*

24.6.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts) (ISS)
24.6.2 Assess user needs to determine which network operating systems to use
24.6.3 Set up/configure workstation-network connections
24.6.4 Set up/configure network components (e.g., interface cards, printers, and CD-ROM devices)
24.6.5 Install modem (ISS)
24.6.6 Install multiplexer
24.6.7 Install LAN operating system
24.6.8 Configure file server in PC network
24.6.9 Construct network cables
24.6.10 Test network connectivity using a network analyzer
24.6.11 Install cabling
24.6.12 Install network

**BIL:** Recommended – ISS, NS
**AC:** Mathematics
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
| NS | | I | IR |

**Competency 24.7: Build Ethernet networks**

*Competency Builders:*

24.7.1 Select an appropriate Ethernet technology from among those currently available
24.7.2 Test Ethernet adapters
24.7.3 Design a traditional ethernet network
24.7.4 Make/test cables
24.7.5 Analyze Ethernet protocols
24.7.6 Locate security leaks
24.7.7 Correct security leaks
24.7.8 Segment an existing network with bridges and switches
24.7.9 Employ switches for collapsed backbones and high-speed serve connections
24.7.10 Alleviate bottlenecks with mixed-speed switches
24.7.11 Examine cost and performance trade-offs
24.7.12 Install Ethernet network
24.7.13 Configure Ethernet network
24.7.14 Integrate Ethernet network with a WAN

**BIL:** Essential – ISS, NS
**AC:** Mathematics, Communications
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 24.8: Perform network operation procedures**

*Competency Builders:*

24.8.1 Determine the type of wiring needed for the physical connection of the network
24.8.2 Connect PCs to form a network
24.8.3 Connect PC to mini or mainframe
24.8.4 Link mixed vendors (e.g., PC to Mac)
24.8.5 Interconnect computers via backbone network
24.8.6 Document LAN configuration
24.8.7 Identify how the network protocols work together
24.8.8 Determine compatibility of various networks
24.8.9 Set up/configure TCP/IP services on workstations and network servers
24.8.10 Implement print queue in a PC network
24.8.11 Program a client-server application
24.8.12 Build a synchronous transmission circuit using a modem

24.8.13 Perform file-to-file copy in a PC network
24.8.14 Install/configure file server in a PC network
24.8.15 Operate the system in a multi-user environment

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | P | |
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**Competency 24.9: Perform hardware and desktop support**
*Competency Builders:*
24.9.1 Redirect output to different printers
24.9.2 Define print devices and job configurations
24.9.3 Check physical and virtual connections
24.9.4 Display server information
24.9.5 Demonstrate disk control
24.9.6 Mount/dismount a CD-ROM
24.9.7 Automate the mounting of a CD-ROM
24.9.8 Develop login scripts using login script commands
24.9.9 Replace computer hardware
24.9.10 Set up system configuration
24.9.11 Start up/shut down system
24.9.12 Install software packages
24.9.13 Respond to system messages
24.9.14 Troubleshoot system
24.9.15 Run software applications
24.9.16 Perform system analysis
24.9.17 Perform preventive maintenance
24.9.18 Check physical and virtual connections
24.9.19 Perform software license audits
24.9.20 Coordinate security procedures

**BIL:** Essential – NS Recommended – ISS
**AC:** Mathematics, Communications
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 24.10: Perform network administration**

*Competency Builders:*

24.10.1 Define the role of the LAN administrator (NS)
24.10.2 Check physical and virtual connections (NS)
24.10.3 Limit server access (NS)
24.10.4 Apply current LAN concepts and technology (NS)
24.10.5 Attach computers and peripherals to LAN (NS)
24.10.6 Install LAN manager software (NS)
24.10.7 Perform administration functions using LAN manager software (NS)
24.10.8 Perform bandwidth optimization (NS)
24.10.9 Respond to system messages (NS)
24.10.10 Troubleshoot system (NS)
24.10.11 Run software applications (NS)
24.10.12 Perform system analysis (NS)
24.10.13 Perform preventive maintenance (NS)
24.10.14 Perform resource management (NS)
24.10.15 Analyze network operations (NS)
24.10.16 Modify network (NS)
24.10.17 Apply established network standards (NS)
24.10.18 Apply standard network address protocols (NS)
24.10.19 Monitor network activity/performance (NS)
24.10.20 Perform trend analyses (NS)
24.10.21 Perform functional verifications, audits, and monitoring (NS)
24.10.22 Coordinate security procedures (NS)
24.10.23 Document actions taken (NS)
24.10.24 Produce reports concerning system conditions (NS)
24.10.25 Document procedures for backups, virus prevention, and software distribution (NS)
24.10.26 Identify new ways of monitoring performance (NS)
24.10.27 Perform capacity and resource planning (NS)

**BIL:** Essential – NS Recommended – ISS
**AC:** Mathematics, Communications
**RC:** CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 24.11: Perform network maintenance and diagnostics and testing**
*Competency Builders:*
24.11.1 Execute network diagnostics program for software (NS)
24.11.2 Execute network diagnostics program for hardware (NS)
24.11.3 Apply standard and protocols (NS)
24.11.4 Document actions taken (maintenance log) (NS)
24.11.5 Establish a preventive maintenance schedule (NS)
24.11.6 Perform preventive maintenance (NS)
24.11.7 Respond to system messages (NS)
24.11.8 Troubleshoot system (NS)
24.11.9 Restore LAN operating systems (NS)
24.11.10 Replace LAN hardware components (NS)
24.11.11 Define the scope and applicability of the test (NS)
24.11.12 Develop a test plan (NS)
24.11.13 Identify needed resources (NS)
24.11.14 Obtain needed resources (NS)
24.11.15 Assess network impact (NS)
24.11.16 Set up test environment (NS)
24.11.17 Set up testing schedule (NS)
24.11.18 Execute testing in accordance with established plans and schedule (NS)
24.11.19 Document errors reported/tracked (NS)
24.11.20 Interpret test results (NS)
24.11.21 Report test results (NS)
24.11.22 Perform system integration testing and volume/performance testing (NS)
24.11.23 Demonstrate knowledge of user acceptance testing (NS)

**BIL:** Essential – NS Recommended – ISS
**AC:** Communications
**RC:** MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 24.12: Explain disaster recovery and business continuance**
*Competency Builders:*
24.12.1 Differentiate between disaster recovery and business resumption (NS)
24.12.2 Identify the steps in a disaster recovery plan (NS)
24.12.3 Identify the steps in a business resumption plan (NS)

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| 24.12.4 | Identify methods for avoiding common computer system disasters (e.g., UPS, RAID) (NS) |
| 24.12.5 | Identify common backup devices (NS) |
| 24.12.6 | Identify the criteria for selecting a backup system (e.g., tape) (NS) |
| 24.12.7 | Compare/contrast streaming and file-by-file backup systems (NS) |
| 24.12.8 | Establish process for archiving files (NS) |
| 24.12.9 | Develop a disaster recovery plan (NS) |
| 24.12.10 | Develop a business resumption plan (NS) |
| 24.12.11 | Back up system (NS) |
| 24.12.12 | Restore system (NS) |

# Unit 25: Basic Mainframe Concepts

**BIL:** Essential – PSD Recommended – ISS
**AC:**
**RC:** NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | | P |

**Competency 25.1: Demonstrate knowledge of mainframe operations**

*Competency Builders:*

25.1.1 Identify types of mainframe memory
25.1.2 Identify data storage techniques used by mainframe operation
25.1.3 Demonstrate knowledge of how data is stored in mainframe computer memory
25.1.4 Demonstrate knowledge of how a mainframe computer system executes program instruction
25.1.5 Demonstrate knowledge of mainframe storage capacity

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics
**RC:** MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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**Competency 25.2: Design multi-tiered applications**

*Competency Builders:*

25.2.1 Demonstrate knowledge of the features, functions, and architectures of client/server computing
25.2.2 Define the objectives of a client/server application
25.2.3 Analyze design requirements
25.2.4 Perform a logical design
25.2.5 Specify needed technology
25.2.6 Identify appropriate migration strategies
25.2.7 Implement online transition processing (OLTP)
25.2.8 Design online analytical processing (OLAP) for data warehousing
25.2.9 Design static and dynamic online processing systems (OLIP/OLAP)
25.2.10 Employ interface techniques

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 25.3: Set up mainframe database systems**

*Competency Builders:*

25.3.1 Create client application resources (e.g., icons, menus, windows, dialogs)
25.3.2 Set up/modify database
25.3.3 Build a help system
25.3.4 Connect heterogeneous databases
25.3.5 Prepare reports using mainframe database

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| PSD | | | I |

**Competency 25.4: Operate mainframe computer systems**

*Competency Builders:*

25.4.1 Interpret terminology associated with mainframe computer operation
25.4.2 Identify data requirements
25.4.3 Access needed information using standard references and sources
25.4.4 Perform log-on procedures
25.4.5 Respond to system messages
25.4.6 Follow processing procedures for each application/job
25.4.7 Determine scheduling priority
25.4.8 Develop audit trails
25.4.9 Develop a test system plan
25.4.10 Handle materials and equipment in a responsible manner
25.4.11 Define user interface standards
25.4.12 Build a job scheduler
25.4.13 Determine resources required to distribute the application

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
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**Competency 25.5: Maintain mainframe computer systems**

*Competency Builders:*

25.5.1 Solve recoverable problems
25.5.2 Maintain security
25.5.3 Maintain computer log
25.5.4 Perform backup procedure(s)
25.5.5 Follow log-off procedure(s)
25.5.6 Establish quality control standards

**BIL:** Recommended – ISS
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 25.6: Store media**

*Competency Builders:*

25.6.1 Determine file and retrieval methods for stored media
25.6.2 Employ visual tool sets, languages, and libraries
25.6.3 Initialize/catalog media
25.6.4 Comply with company and/or government standards for media security
25.6.5 Maintain archives of company records as required by policy or law

# Unit 26: Database Management System Basics

**BIL:** Essential – ISS, PSD, IM
**AC:** Communications
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | I | P |
| IM | | I | P |

**Competency 26.1: Demonstrate knowledge of Database Management System (DBMS) basics**

*Competency Builders:*

26.1.1 Interpret terminology associated with relational databases (ISS, PSD, IM)
26.1.2 Demonstrate knowledge of the features, functions, and architecture of a DBMS (ISS, PSD, IM)
26.1.3 Trace the evolution of DBMS models and their implementation (IM)
26.1.4 Identify the uses of a DBMS in business organizations (ISS, PSD, IM)
26.1.5 Demonstrate knowledge of the concepts necessary to access organizational databases (ISS, PSD, IM)
26.1.6 Analyze the organization of data in a DBMS (ISS, PSD)
26.1.7 Identify the impact of networks on DBMS
26.1.8 Demonstrate knowledge of how a DBMS ensures data integrity through transaction-control techniques

**BIL:** Essential – ISS Recommended – PSD, IM
**AC:** Mathematics
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | I | P |
| IM | | | I |

**Competency 26.2: Employ computational and logical operators**

*Competency Builders:*

26.2.1 Create programs using basic arithmetic operators (ISS)
26.2.2 Develop programs using various relational operators and compound conditions (ISS)
26.2.3 Develop a data model for computation (ISS)

**BIL:** Essential – ISS, PSD Recommended – IM
**AC:**
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| PSD | | I | P |
| IM | | | I |

**Competency 26.3: Develop report-preparation programs**
*Competency Builders:*
26.3.1 Create database objects
26.3.2 Produce formatted reports (ISS, PSD)
26.3.3 Produce single- and multiple-level control break reports and subtotal and final totals (ISS, PSD)

**BIL:** Essential – ISS, PSD
**AC:**
**RC:** MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
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| PSD | | I | P |

**Competency 26.4: Develop database programs**
*Competency Builders:*
26.4.1 Write programs that allow the user to make a menu choice to carry out an appropriate action (PSD)
26.4.2 Write programs that require statements to be executed multiple times by using structured programming (PSD)
26.4.3 Write programs that access multiple files (PSD)
26.4.4 Design an information system within a database environment

**BIL:** Essential – ISS, PSD Recommended – IM
**AC:**
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | I | P |
| IM | | | I |

**Competency 26.5: Employ a DBMS**
*Competency Builders:*

26.5.1 Build database applications (ISS, PSD)
26.5.2 Distribute data across a distributed DBMS (PSD)
26.5.3 Analyze/model organizations using Entity-Relationship and Object technologies (PSD)
26.5.4 Remove data anomalies through the process of normalization (PSD)
26.5.5 Create/update a relational database using Structured Query Language (PSD)
26.5.6 Query a relational database using Structured Query Language (PSD)
26.5.7 Query data from an organizational repository using a database access facility (PSD)
26.5.8 Perform database administration tasks (PSD)

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics, Communications
**RC:** MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | I |

**Competency 26.6: Manage implementation of a DBMS**
*Competency Builders:*

26.6.1 Execute implementation plan according to project time line
26.6.2 Implement transition plan with minimal impact on productivity
26.6.3 Conduct user training
26.6.4 Define needed external informational resources (e.g., source, content, cost, and timeliness)
26.6.5 Access external information resources using Internet tools
26.6.6 Create/maintain a directory of external information resources
26.6.7 Develop editors to facilitate data entry
26.6.8 Design simple reports for validating the performance of application systems
26.6.9 Apply software development principles, methods, and tools in implementing IS applications
26.6.10 Apply database design techniques to the implementation of a solution with calls from a program to the DBMS

26.6.11 Apply networking considerations in implementing distributed models
26.6.12 Develop server applications for installation and operation in a multi-user environment

**BIL:** Essential – ISS Recommended – PSD
**AC:** Communications
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | | I |

**Competency 26.7: Monitor a DBMS**

*Competency Builders:*

26.7.1 Coordinate security requirements, including documentation functions
26.7.2 Identify desired levels of access and security (ISS)
26.7.3 Communicate decisions concerning levels of access and security (ISS)
26.7.4 Select monitoring tools and procedures
26.7.5 Identify monitoring methodologies
26.7.6 Identify problems in a timely fashion
26.7.7 Document problems
26.7.8 Propose solutions that are congruent with application requirements
26.7.9 Implement solutions to problems
26.7.10 Calibrate DBMS configuration parameters for optimum performance

# Unit 27: Database Administration

**BIL:** Essential – ISS, PSD
**AC:** Mathematics
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | |
| PSD | | I | P |

**Competency 27.1: Apply databases to actual situations and business problems**

*Competency Builders:*

27.1.1 Derive database design from a workflow drawing or other requirement documents (PSD)
27.1.2 Design a database to solve a business problem or other real-life problem situation (PSD)
27.1.3 Identify the relationship between database components (PSD)
27.1.4 Sort data on multiple fields (PSD)
27.1.5 Add/remove filters (PSD)
27.1.6 Create queries with multiple criteria (PSD)
27.1.7 Create/apply different types of queries (PSD)
27.1.8 Join tables in a query (PSD)
27.1.9 Enhance the design of a form (PSD)
27.1.10 Create needed subforms (PSD)
27.1.11 Group data in reports (PSD)
27.1.12 Make a calculation on a report (PSD)
27.1.13 Imbed data and graphics (PSD)
27.1.14 Import data and graphics (PSD)
27.1.15 Link data and graphics (PSD)

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics, Communications
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | | I |

**Competency 27.2: Apply data modeling techniques**

*Competency Builders:*

27.2.1 Interpret terminology associated with data models
27.2.2 Compare/contrast various data models
27.2.3 Analyze data models
27.2.4 Develop a data model to describe an application's data

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics, Communications
**RC:** MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | | I |

**Competency 27.3: Create conceptual data models**

*Competency Builders:*

27.3.1 Analyze model requirements
27.3.2 Identify business entities and the relationships between them
27.3.3 Define data in an integrated data dictionary
27.3.4 Ensure that conceptual model includes tools to facilitate user access

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:** MCDBA

| EDU: | 10 | 12 | AD |
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**Competency 27.4: Validate conceptual data models**

*Competency Builders:*

27.4.1 Present conceptual data model to client
27.4.2 Resolve issues with client
27.4.3 Secure client approval for model
27.4.4 Feed recommendations back into the modeling process
27.4.5 Document validation process

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 27.5: Integrate conceptual data models with enterprise models**

*Competency Builders:*

27.5.1 Ensure that conceptual data model is consistent with enterprise model (e.g., entity names, relationships, and definitions)
27.5.2 Develop conceptual schema
27.5.3 Secure client approval for modifications in enterprise models

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 27.6: Reconcile conceptual models with appropriate-level process models**

*Competency Builders:*

27.6.1 Verify consistencies between models
27.6.2 Identify areas of overlap
27.6.3 Verify that data entities in process model have a corresponding entity data model
27.6.4 Document changes or modifications in either model

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics
**RC:** MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 27.7: Create logical data models**

*Competency Builders:*

27.7.1 Map data model to a relational model
27.7.2 Identify attributes of model entities and relationships between them
27.7.3 Verify that logical model is consistent with conceptual model
27.7.4 Specify integrity constraints

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 27.8: Distinguish unique identifiers**
*Competency Builders:*
27.8.1 Document identifiers
27.8.2 Identify rationale for selection of identifiers
27.8.3 Validate identifiers with client

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics, Communications
**RC:** MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | I |

**Competency 27.9: Normalize data models**
*Competency Builders:*
27.9.1 Normalize logical data model in accordance with established company policy
27.9.2 Verify that data model matches specifications
27.9.3 Validate logical data model with client

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | I |

**Competency 27.10: Reconcile conceptual models with lower process models**
*Competency Builders:*
27.10.1 Verify consistencies between models
27.10.2 Identify areas of overlap
27.10.3 Verify that data entities in process model have a corresponding entity data model
27.10.4 Document changes or modifications in either model
27.10.5 Integrate logical data model with enterprise model

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | | I |

**Competency 27.11: Determine environment/platform for physical data models**
*Competency Builders:*
27.11.1 Research potential computer environments/platforms
27.11.2 Identify platform capabilities and limitations
27.11.3 Select environment/platform based on technical, business, and skill information gathered
27.11.4 Secure approval of target environment/platform

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| PSD | | | I |

**Competency 27.12: Identify backup and recovery requirements for physical models**
*Competency Builders:*
27.12.1 Establish backup requirements consistent with corporate policy and business needs
27.12.2 Document established backup procedures
27.12.3 Control access to database to maintain security

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 27.13: Identify model access requirements**
*Competency Builders:*
27.13.1 Identify inputs, output, and volume of every user view
27.13.2 Categorize user views by type of transaction
27.13.3 Document access to data by type of access
27.13.4 Integrate access requirements with backup and recovery plan

**BIL:** Essential – ISS, PSD
**AC:** Mathematics
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | | I | P |

**Competency 27.14: Identify physical database characteristics**
*Competency Builders:*
27.14.1 Identify name, type, and length of attributes (ISS, PSD)
27.14.2 Employ table and file names that conform to naming conventions (ISS, PSD)
27.14.3 Group/assign tables to disk files
27.14.4 Index files for performance and integrity (ISS, PSD)
27.14.5 Verify that data types are consistent between attributes (ISS, PSD)
27.14.6 Employ normalization and modeling as cross-checking techniques

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | P |

**Competency 27.15: Reconcile physical design with processing requirements**
*Competency Builders:*
27.15.1 Resolve conflicts between physical model and process model
27.15.2 Verify that data entities in process model have a corresponding entity data model
27.15.3 Document changes made to either model

# Unit 28: Data Warehousing

**BIL:** Essential – ISS, PSD
**AC:** Mathematics
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| PSD | | | P |

**Competency 28.1: Demonstrate knowledge of basic data warehousing concepts**

*Competency Builders:*

28.1.1 Differentiate between traditional databases and data warehouses (ISS)
28.1.2 Recognize importance of data warehouses and integration (ISS)
28.1.3 Recognize that information is a competitive resource
28.1.4 Identify components of data warehouses (e.g., subject-oriented, integrated, time-variant, nonvolatile)
28.1.5 Identify the characteristics and uses of metadata (ISS)
28.1.6 Define types of information (e.g., associations, sequences, classifications, clusters, and forecasting) (ISS)
28.1.7 Demonstrate knowledge of data conversion techniques and functions
28.1.8 Identify types of programs and applications for data warehousing
28.1.9 Identify types of data mining tools (i.e., neural networks, decision trees, rule induction, and data visualization)
28.1.10 Define public summary data
28.1.11 Demonstrate knowledge of ethical issues of data warehousing (ISS)

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | | P |

**Competency 28.2: Apply ethical behaviors to data warehousing**

*Competency Builders:*

28.2.1 Define appropriate security measures
28.2.2 Analyze the limitations of external data
28.2.3 Identify ethical uses of data
28.2.4 Define use of permanent detail data for legal or ethical purposes

**BIL:** Essential – ISS Recommended – PSD
**AC:**
**RC:** MCP, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | | I |

**Competency 28.3: Perform data entry and updating**

*Competency Builders:*

28.3.1 Develop an entity-relationship diagram
28.3.2 Employ appropriate index or indices
28.3.3 Define data repositories
28.3.4 Design metamodel
28.3.5 Apply appropriate security measures
28.3.6 Differentiate between permanent detail data and regular data
28.3.7 Apply skill in working with data programs
28.3.8 Maintain metadata
28.3.9 Size data warehouse
28.3.10 Load/transfer data (map data)
28.3.11 Scrub/filter data

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| PSD | | | I |

**Competency 28.4: Perform data retrieval**

*Competency Builders:*

28.4.1 Locate appropriate data warehouses
28.4.2 Perform strategic analyses using a multidimensional database
28.4.3 Secure necessary indices
28.4.4 Design reasonable query
28.4.5 Define nature of application
28.4.6 Apply appropriate security measures
28.4.7 Obtain necessary responses from data query
28.4.8 Calculate derived and aggregate data
28.4.9 Validate the processing of data

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics, Communications
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | I |

**Competency 28.5: Apply data**

*Competency Builders:*

28.5.1 Optimize query procedures
28.5.2 Evaluate information gathered in query
28.5.3 Utilize public summary data
28.5.4 Design reporting medium
28.5.5 Perform online analytical processing
28.5.6 Construct report from data gathered

# Unit 29: Application Development Life Cycle

**BIL:** Essential – ISS, PSD
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | I | P |

**Competency 29.1: Conduct needs analysis**

*Competency Builders:*

29.1.1 Define business problem to be solved by the application (e.g., through interview process) (PSD)
29.1.2 Identify scope of project (PSD)
29.1.3 Access needed information using company procedural manuals, references, documentation, and standards
29.1.4 Define business information requirements
29.1.5 Align information system (IS) design with the business process
29.1.6 Determine hardware and software needs (PSD)
29.1.7 Interpret source data, charts, and graphs (PSD)
29.1.8 Review organizational structure
29.1.9 Interpret existing operating documents and procedures for the system
29.1.10 Observe existing procedures
29.1.11 Document existing procedures
29.1.12 Document possible alternative solutions
29.1.13 Identify processing requirements
29.1.14 Define variables (PSD)
29.1.15 Analyze specifications (PSD)
29.1.16 Present findings and recommendations to users and management (e.g., work plan, project estimate)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | | I | P |

**Competency 29.2: Design computer applications**

*Competency Builders:*

29.2.1 Establish standards and policies to govern the development of organizational information systems
29.2.2 Consider the benefits of using a cross-functional team in policy and procedure development

29.2.3 Identify development team
29.2.4 Develop team mission statement aligned with organizational mission
29.2.5 Determine the roles of user and management in the computer system development process
29.2.6 Outline steps for program development cycle, (e.g., prototyping, storyboarding) (PSD)
29.2.7 Identify processing requirements (PSD)
29.2.8 Create specs with development team (PSD)
29.2.9 Divide design specifications into logical blocks (e.g., flowchart, dataflow diagram, system flow record and layout) (PSD)
29.2.10 Identify constraints (e.g., political, financial, time, hardware, and systems)
29.2.11 Select programming language (PSD)
29.2.12 Select hardware platform
29.2.13 Establish input and output (I/O) requirements (PSD)
29.2.14 Design system input/output processes
29.2.15 Prepare logic using program flowchart (PSD)
29.2.16 Differentiate between system documentation and user documentation
29.2.17 Employ top-down design and structured programming (PSD)
29.2.18 Define arrays and tables (PSD)
29.2.19 Determine compilers to be used in design (PSD)
29.2.20 Determine iteration (looping) to be used (PSD)
29.2.21 Apply rules for naming variables (PSD)
29.2.22 Apply normalization rules to data attributes
29.2.23 Define test data to be developed (PSD)
29.2.24 Employ normalization and modeling as cross-checking techniques
29.2.25 Maintain project scope
29.2.26 Create design documentation (PSD)
29.2.27 Present system design (PSD)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics, Communications
**RC:** MCP, MCSD

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| PSD | I | P | PR |

**Competency 29.3: Develop computer programs in accordance with programming theory**
*Competency Builders:*
29.3.1 Apply established operating system development tools, commands, utilities, and standards
29.3.2 Evaluate operating system constraints
29.3.3 Develop programs using file-handling techniques
29.3.4 Develop intuitive user interfaces
29.3.5 Develop programs using data-validation techniques
29.3.6 Develop interactive processes

29.3.7 Develop menu-driven programs
29.3.8 Develop database programs
29.3.9 Develop programs that utilize a recursive process
29.3.10 Develop programs using copy libraries
29.3.11 Develop programs using system calls
29.3.12 Develop programs using design tool
29.3.13 Develop programs using arrays, both one- and two-dimensional
29.3.14 Write source code per standards
29.3.15 Plan program output using a spacing chart
29.3.16 Code a modular program
29.3.17 Interpret a simple hierarchy chart
29.3.18 Interpret a simple pseudocode design
29.3.19 Perform program sorts
29.3.20 Design a decision table for a specified problem
29.3.21 Employ loops
29.3.22 Apply logical operators (e.g., AND, OR, NOT)
29.3.23 Code error-handling techniques
29.3.24 Employ data files
29.3.25 Comply with commenting and internal documentation standards
29.3.26 Perform character manipulation
29.3.27 Declare/initialize variables
29.3.28 Modify variables
29.3.29 Evaluate series of logical expressions
29.3.30 Code separate addition, subtraction, multiplication, and division statements
29.3.31 Initialize arrays
29.3.32 Generate executable code
29.3.33 Employ functions (e.g., library, user-defined, sting)
29.3.34 Write arithmetic statements
29.3.35 Write I/O statements
29.3.36 Write internal documentation
29.3.37 Write subroutines
29.3.38 Employ conditional statements

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics
**RC:** MCP, MCSD

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
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**Competency 29.4: Test programs**

*Competency Builders:*

29.4.1 Perform debugging functions
29.4.2 Debug syntax errors
29.4.3 Create test data and plan for checking logic and error routines

29.4.4 Execute program with test data
29.4.5 Correct execution errors
29.4.6 Perform unit and integration tests
29.4.7 Analyze test results
29.4.8 Correct logic errors
29.4.9 Perform usability tests

**BIL:** Essential – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| PSD | | | P |

**Competency 29.5: Develop documentation**
*Competency Builders:*
29.5.1 Identify documentation needs
29.5.2 Prepare program documentation
29.5.3 Prepare user documentation
29.5.4 Prepare dataflow diagrams
29.5.5 Update design documentation
29.5.6 Establish documentation-update method

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
| PSD | | I | P |

**Competency 29.6: Evaluate system**
*Competency Builders:*
29.6.1 Identify evaluation criteria (PSD)
29.6.2 Develop test plan (PSD)
29.6.3 Conduct tests (PSD)
29.6.4 Analyze test data (PSD)
29.6.5 Present test results (PSD)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Mathematics, Science, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |
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**Competency 29.7: Install computer application system**
*Competency Builders:*
29.7.1 Review organizational structure
29.7.2 Interpret existing operating documents and procedures for the system
29.7.3 Design implementation plan
29.7.4 Present implementation plan to users and management
29.7.5 Perform implementation or changeover to new system
29.7.6 Perform post-implementation evaluation of new system
29.7.7 Correct deficiencies
29.7.8 Train personnel
29.7.9 Identify ongoing support requirements

**BIL:** Recommended – ISS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | I |

**Competency 29.8: Measure quality assurance**
*Competency Builders:*
29.8.1 Identify metrics for measurement
29.8.2 Establish baseline performance
29.8.3 Measure actual performance and baseline performance

# Unit 30: Information Systems (IS) Theory

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics
**RC:** CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | I | P |
| PSD | | I | P |

**Competency 30.1: Demonstrate a basic knowledge of systems theory and quality concepts**

*Competency Builders:*

30.1.1 Demonstrate knowledge of the underlying concepts of the information systems discipline (ISS, NS)
30.1.2 Compare/contrast data, information, and knowledge (ISS, NS)
30.1.3 Demonstrate knowledge of methods for achieving productivity in knowledge work (NS)
30.1.4 Apply general systems theory to the analysis and development of an information system (NS)
30.1.5 Identify the properties of open systems (NS)
30.1.6 Define the relationship between system components (ISS, NS)
30.1.7 Characterize the role of data representation, both non-numeric and numeric (e.g., integers, reals, errors) (ISS, NS)
30.1.8 Identify procedures for formal problem solving (NS)
30.1.9 Demonstrate knowledge of the fundamental concept of information theory and organizational system processes (ISS, NS)
30.1.10 Identify the essential properties of information systems (NS)
30.1.11 Differentiate between the role of information systems within a company and their role in a global environment (NS)

**BIL:** Recommended – ISS, NS, PSD
**AC:**
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | | I | P |
| PSD | | I | P |

**Competency 30.2: Identify system infrastructure**

*Competency Builders:*

30.2.1 Select a systems development model
30.2.2 Demonstrate knowledge of the components of the system infrastructure (e.g., hardware, communications, database, site)
30.2.3 Identify the relationship of users and suppliers to the system
30.2.4 Identify the objectives of system
30.2.5 Identify the process for selecting software products and processes
30.2.6 Identify the development cycle
30.2.7 Outline the system controls

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 30.3: Select systems development approach**

*Competency Builders:*

30.3.1 Summarize application planning, development, and risk management for information system
30.3.2 Identify potential problems in system implementation
30.3.3 Determine whether prototyping system is feasible
30.3.4 Expand development plan using packages
30.3.5 Develop a plan using data-oriented techniques
30.3.6 Employ object-oriented development techniques
30.3.7 Employ process-oriented development techniques
30.3.8 Evaluate systems engineering considerations
30.3.9 Determine software design process, from specification to implementation
30.3.10 Appraise software process and product life-cycle models
30.3.11 Assess software design methods and tools

**BIL:** Recommended – ISS
**AC:** Mathematics
**RC:** CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
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**Competency 30.4: Compare/contrast individual and collaborative knowledge work**

*Competency Builders:*

30.4.1 Identify stakeholders in a given IS context
30.4.2 Identify desired group and team behavior in an IS context
30.4.3 Demonstrate knowledge of how to apply team methods to empower coworkers
30.4.4 Measure empowerment and effectiveness
30.4.5 Identify knowledge-building and knowledge-maintaining tasks
30.4.6 Differentiate between individual and group technology
30.4.7 Demonstrate knowledge of the characteristics and attributes of knowledge work for both individual and group technology
30.4.8 Demonstrate knowledge of group support technology for common knowledge requirements
30.4.9 Identify work modifications necessitated by working in groups (e.g., additional processing)
30.4.10 Evaluate success of work
30.4.11 Demonstrate knowledge of the information analysis process
30.4.12 Demonstrate knowledge of information technology solutions

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:** Mathematics
**RC:** CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
| NS | | I | IR |
| PSD | | I | P |

**Competency 30.5: Plan strategies for implementing system**

*Competency Builders:*

30.5.1 Identify data requirements through questioning of individuals and groups
30.5.2 Determine information requirements through analysis of individual and group tasks
30.5.3 Identify information technology requirements for given worksite
30.5.4 Identify computer hardware
30.5.5 Specify the data structures to be implemented
30.5.6 Select overall implementation strategy (e.g., top-down, bottom up; teams vs. individual)
30.5.7 Analyze the interaction of the operating system and hardware architecture
30.5.8 Determine the database management system to be implemented
30.5.9 Establish ownership of data and system

30.5.10 Determine methods for providing computing support for the end user
30.5.11 Plan measures to ensure system integrity

**BIL:** Essential – ISS, NS
**AC:** Mathematics, Communications
**RC:** CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
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**Competency 30.6: Facilitate measures of achievement**

*Competency Builders:*

30.6.1 Evaluate potential systems solutions against criteria for success
30.6.2 Apply continuous improvement methodologies
30.6.3 Identify quality standards to be documented (e.g., ISO, Baldridge)
30.6.4 Identify the competitive advantage achieved through IS
30.6.5 Specify measurements to be taken
30.6.6 Assign responsibility for documentation

# Unit 31: Information Systems Management

**BIL:** Essential – NS Recommended – ISS
**AC:** Mathematics, Communications
**RC:** CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
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| NS | | | P |

**Competency 31.1: Conduct organizational planning for information systems**

*Competency Builders:*

31.1.1 Demonstrate knowledge of the strategic role of information systems in organizations
31.1.2 Demonstrate knowledge of data administration and access to corporate information resources
31.1.3 Identify information technology needed to support given sets of tasks and activities for individuals, workgroups, and the organization
31.1.4 Align IS planning with enterprise planning
31.1.5 Define the strategic relationship of IS activities to enhancing competitive position
31.1.6 Differentiate between strategic tactical and operational level applications
31.1.7 Define the role of IS within strategic plan for the total company
31.1.8 Define the IS role in process re-engineering
31.1.9 Develop short-range IS plan
31.1.10 Develop continuous improvement plan
31.1.11 Determine functional structures (internal vs. outsourcing)
31.1.12 Establish goals and objectives for IS
31.1.13 Define mission and critical success factors
31.1.14 Formulate IS operating procedures

**BIL:** Recommended – ISS
**AC:**
**RC:** CCNA-Curr

| EDU: | 10 | 12 | AD |
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**Competency 31.2: Establish how information systems will be developed and managed within the organization**

*Competency Builders:*

31.2.1 Identify hierarchical and flow models of the organization
31.2.2 Identify organizational work groups
31.2.3 Define the roles of professional IS personnel within the organization
31.2.4 Define the function of IS management
31.2.5 Identify drivers and inhibitors of information technology change in the organization

31.2.6 Define the role of the cognitive process in information systems design and implementation

31.2.7 Identify IS support for decision making

**BIL:** Recommended – ISS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 31.3: Initiate control of IS function**

*Competency Builders:*

31.3.1 Design a methodology to ensure that external audits will establish consistent goals and accomplishments

31.3.2 Conduct EDP audits

31.3.3 Evaluate the advantages and disadvantages of various options for outsourcing IS function

31.3.4 Conduct internal and external performance evaluations for IS function

31.3.5 Define how information and information systems will be used in documentation, decision making, and control of organizational activity

31.3.6 Define the relationship between systems goals and quality concepts

31.3.7 Define the roles of information technology and of the people using, designing, and managing IT in an organization

31.3.8 Implement an IS application using code generators

31.3.9 Compare the results of implementation using code generators with hand-coded versions of the same application

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Communications
**RC:** NKC

| EDU: | 10 | 12 | AD |
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**Competency 31.4: Manage IS subfunctions**

*Competency Builders:*

31.4.1 Create technical and end-user telecommunication system documentation

31.4.2 Identify security and privacy considerations

31.4.3 Resolve security and privacy issues within the context of the telecommunications system

31.4.4 Analyze configuration controls

31.4.5 Develop DBMS projects, including systems development and user documentation

31.4.6 Develop assignments and performance rating measures to evaluate the development process (working individually or as a member of a team)
31.4.7 Manage computer facilities
31.4.8 Manage group decision support systems
31.4.9 Optimize the climate for creativity
31.4.10 Resolve operational issues associated with system installation
31.4.11 Manage software engineering activities

**BIL:** Recommended – ISS
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 31.5: Apply management principles to IS functions**
*Competency Builders:*
31.5.1 Identify the characteristics of principle-centered leadership
31.5.2 Employ a proactive approach to IS management
31.5.3 Devise techniques to enhance the creative design process
31.5.4 Justify the project management approach to be implemented

# Unit 32: Information System Analysis and Design

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
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| PSD | | I | P |

**Competency 32.1: Demonstrate knowledge of the role of systems analysts**
*Competency Builders:*
32.1.1 Identify the functions of systems analysts (ISS)
32.1.2 Identify the skills required for systems analysts (ISS)

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:**
**RC:** CCNA-Curr, CNE

| EDU: | 10 | 12 | AD |
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| NS | | | I |
| PSD | | I | P |

**Competency 32.2: Initiate a system project**
*Competency Builders:*
32.2.1 Identify the phases in a system project
32.2.2 Select basic fact-gathering techniques to be used
32.2.3 Define the scope of the systems project
32.2.4 Conduct a preliminary investigation

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:**
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 32.3: Perform a detailed system investigation and analysis**
*Competency Builders:*
32.3.1 Identify time, technology and resource constraints
32.3.2 Determine investigation techniques to be used
32.3.3 Record facts gathered through system investigation
32.3.4 Perform appropriate diagnostic tests
32.3.5 Investigate system alerts
32.3.6 Research technical alternatives
32.3.7 Evaluate technical alternatives

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:**
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 32.4: Design an information system**
*Competency Builders:*
32.4.1 Execute the steps in system design
32.4.2 Design system output, system input, files, and processing
32.4.3 Analyze the interaction of the operating system and hardware architecture
32.4.4 Justify the communications selections for the system (e.g., single PCs, LANs and/or WANs)
32.4.5 Present system design to management

**BIL:** Essential – ISS Recommended – PSD
**AC:**
**RC:** CNE

| EDU: | 10 | 12 | AD |
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**Competency 32.5: Develop the information system**
*Competency Builders:*
32.5.1 Execute tasks involved in system development
32.5.2 Identify the system components and their relationships
32.5.3 Specify the workflow system
32.5.4 Employ techniques to enhance the creative design process
32.5.5 Develop programming specifications
32.5.6 Program the system
32.5.7 Test the system
32.5.8 Document the system

**BIL:** Essential – ISS Recommended – PSD
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 32.6: Evaluate applications within the information system**
*Competency Builders:*
32.6.1 Design a framework for evaluating information system functions
32.6.2 Design a framework for evaluating individual applications
32.6.3 Compare the capabilities of an application with the requirements it is intended to meet
32.6.4 Identify alternative outcomes of the application verification process
32.6.5 Evaluate the results and the probabilities of errors in application software
32.6.6 Modify inputs, outputs, and processing to refine an application
32.6.7 Recommend new features or enhancements to existing tools

**BIL:** Recommended – ISS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 32.7: Develop IS implementation plan**

*Competency Builders:*

32.7.1 Analyze the effect of IS on the organizational structure
32.7.2 Depict the interaction between IS and continuous improvement
32.7.3 Specify the teamwork, leadership, and empowerment strategies to be used
32.7.4 Determine consensus-building process to be used
32.7.5 Convert existing files
32.7.6 Determine the system conversion method to be used
32.7.7 Document system implementation plans

**BIL:** Recommended – ISS, PSD
**AC:** Mathematics, Communications
**RC:** CNE

| EDU: | 10 | 12 | AD |
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**Competency 32.8: Perform management functions related to the planned change**

*Competency Builders:*

32.8.1 Schedule system change according to risk
32.8.2 Secure needed approvals for change
32.8.3 Document contingency plans
32.8.4 Formulate a time line for the implementation of change
32.8.5 Coordinate activities among work groups
32.8.6 Perform regression tests
32.8.7 Document testing results
32.8.8 Initiate problem correction

# Unit 33: System Installation and Maintenance

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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| PSD | | | P |

**Competency 33.1: Apply knowledge of the life cycle of an information system**
*Competency Builders:*
33.1.1 Research the concept of information system life cycles
33.1.2 Identify criteria for deciding between acquisition of software packages and custom development of software

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics, Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 33.2: Install system**
*Competency Builders:*
33.2.1 Develop a detailed training, conversion, and installation plan for an information system application (NS)
33.2.2 Design networked solutions (NS)
33.2.3 Install DBMS on the server (NS)
33.2.4 Install appropriate operating system and telecommunications hardware and software (NS)
33.2.5 Identify system requirements for various types of installations (NS)
33.2.6 Evaluate installation requirements (NS)
33.2.7 Install information system application program in accordance with requirements (NS)
33.2.8 Evaluate processes and outcomes (NS)
33.2.9 Customize a general-purpose software package to provide specific functionality beyond the default settings (NS)
33.2.10 Add capability to a software system by recording macros and storing them in the system's library (NS)
33.2.11 Access needed technical information using software help facilities (NS)
33.2.12 Operate server applications (NS)

33.2.13 Ensure that all multi-user aspects of the application function are operational (NS)
33.2.14 Operate coupled application systems (NS)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCSD, MCDBA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 33.3: Perform software configuration and loading**
*Competency Builders:*
33.3.1 Develop program and system specifications (NS)
33.3.2 Load software with minimum disruption of process flow (NS)
33.3.3 Convert data (NS)
33.3.4 Resolve compatibility issues (NS)
33.3.5 Configure software appropriately for system and user application (NS)
33.3.6 Perform software coding (NS)
33.3.7 Participate in application and system development reviews (NS)
33.3.8 Evaluate emerging technologies and their potential effect on information system software (NS)
33.3.9 Assemble necessary components to implement information system design (NS)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCSD, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 33.4: Monitor the information system**
*Competency Builders:*
33.4.1 Conduct post-implementation evaluation (NS)
33.4.2 Identify abnormal system performance (NS)
33.4.3 Determine required service levels (NS)
33.4.4 Monitor multiple technologies (NS)
33.4.5 Recognize system alerts (NS)
33.4.6 Recognize security problems (NS)
33.4.7 Recognize environmental problems (NS)
33.4.8 Perform remote monitoring (NS)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics, Communications
**RC:** A+, CCNA, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 33.5: Perform system maintenance**
*Competency Builders:*
33.5.1 Demonstrate knowledge of the basic elements of computer maintenance
33.5.2 Identify available diagnostic tools used for system maintenance
33.5.3 Identify maintenance procedures and processes
33.5.4 Identify problems using diagnostic tools
33.5.5 Document solutions
33.5.6 Tear down a computer
33.5.7 Identify (by name) new or replacement computer components needed
33.5.8 Install/replace computer components
33.5.9 Reassemble a computer
33.5.10 Establish a preventive maintenance plan
33.5.11 Perform preventive maintenance on computer components
33.5.12 Create maintenance plan for regular integrity checks
33.5.13 Evaluate maintenance processes
33.5.14 Evaluate maintenance outcomes

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:** Mathematics, Communications
**RC:** MCP, MCSE, MCDBA, CNA, CNE

| EDU: | 10 | 12 | AD |
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| PSD | | I | P |

**Competency 33.6: Manage backup and recovery, both on- and off-site**
*Competency Builders:*
33.6.1 Develop backup plan to be used by technical support group and users
33.6.2 Develop recovery plan to be used by technical support group and users
33.6.3 Implement backup procedures in accordance with a regular schedule
33.6.4 Implement recovery procedures as needed
33.6.5 Evaluate whether backup and recovery plans meet users' needs

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 33.7: Troubleshoot problems**

*Competency Builders:*

33.7.1 Demonstrate knowledge of basic troubleshooting steps (NS)
33.7.2 Detect problems (NS)
33.7.3 Identify criticality of problem (NS)
33.7.4 Perform appropriate analyses to identify problem cause (NS)
33.7.5 Develop resolution plan (NS)
33.7.6 Identify possible solutions (NS)
33.7.7 Test identified solutions (NS)
33.7.8 Select most appropriate solution (NS)
33.7.9 Implement selected solution (NS)
33.7.10 Minimize impact of problems on productivity (e.g., minimize downtime) (NS)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Mathematics
**RC:** A+, CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| PSD | | I | P |

**Competency 33.8: Evaluate problem-solving processes and outcomes**

*Competency Builders:*

33.8.1 Evaluate problem-solving outcomes to determine whether the problem was solved as intended (NS)
33.8.2 Evaluate whether the process was applied in an efficient and responsible manner (NS)
33.8.3 Assess the validity and usefulness of the outcomes (NS)
33.8.4 Determine needed follow-up actions (NS)

**BIL:** Essential – ISS, NS Recommended – PSD
**AC:** Communications
**RC:** A+, CCNA, CCNA-Curr, MCP, MCSE, MCDBA, CNA, CNE

| EDU: | 10 | 12 | AD |
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| NS | | P | |
| PSD | | I | P |

**Competency 33.9: Perform software upgrades and fixes**

*Competency Builders:*

33.9.1 Identify principles governing software acquisition and upgrades
33.9.2 Analyze operational problems
33.9.3 Recommend solutions for operational problems
33.9.4 Upgrade software

# Unit 34: System Administration and Control

**BIL:** Essential – ISS, NS
**AC:** Mathematics, Science, Communications
**RC:** CNA, CNE

| EDU: | 10 | 12 | AD |
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| ISS | | | P |
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**Competency 34.1: Perform general system administration tasks**

*Competency Builders:*

34.1.1 Facilitate the delivery of technical services (NS)
34.1.2 Set up/maintain user accounts on multiple systems (NS)
34.1.3 Provide technical product support (NS)
34.1.4 Perform planning for overall system functions (NS)
34.1.5 Prepare cost justifications (NS)
34.1.6 Manage inventory and assets (NS)
34.1.7 Identify new application requirements within the system (NS)
34.1.8 Participate in the evaluation, analysis, and recommendation of technical computing products (NS)
34.1.9 Participate in evaluation of total system (NS)
34.1.10 Document performance problems (NS)
34.1.11 Retrieve historical data for trend analysis (NS)
34.1.12 Analyze historical data to identify trends (NS)
34.1.13 Provide input on technical procedures (NS)
34.1.14 Increase knowledge of system infrastructure (NS)
34.1.15 Formulate technical procedures (NS)
34.1.16 Prepare documentation manuals (NS)
34.1.17 Prepare required reports (NS)
34.1.18 Maintain technical industry knowledge (NS)

**BIL:** Essential – ISS
**AC:**
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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**Competency 34.2: Apply data structure concepts to the storage and retrieval of data**

*Competency Builders:*

34.2.1 Map data model to a relational model
34.2.2 Create records
34.2.3 Enter records into physical files
34.2.4 Create logical files
34.2.5 Employ logical files

**BIL:** Essential – ISS
**AC:**
**RC:** MOUS, MCP, MCSD, MCDBA

| EDU: | 10 | 12 | AD |
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**Competency 34.3: Query a database**

*Competency Builders:*

34.3.1 Create a query to extract information from a single file
34.3.2 Create a query to extract information from multiple files
34.3.3 Created nested queries
34.3.4 Create reports and/or files from queries

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** MOUS, MCP, MCSD

| EDU: | 10 | 12 | AD |
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**Competency 34.4: Create menus and display screens using system utilities**

*Competency Builders:*

34.4.1 Create a menu that allows different actions to be taken on a database file
34.4.2 Create a display screen for use with a high-level language program
34.4.3 Test menu and display screens created
34.4.4 Create integrated applications

**BIL:** Essential – ISS
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | | P |

**Competency 34.5: Develop control language programs to access system functions and database files**

*Competency Builders:*

34.5.1 Explain the role of control language in relation to other languages
34.5.2 Create, compile and test control language programs
34.5.3 Compile control language programs
34.5.4 Test control language programs
34.5.5 Build forms using a layout editor
34.5.6 Integrate forms, reports, and graphics

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** MOUS, MCP, MCSD, MCDBA, CNA, CNE

| EDU: | 10 | 12 | AD |
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**Competency 34.6: Transfer files between mid-range and microcomputer systems**
*Competency Builders:*
34.6.1 Upload files to a mid-range computer
34.6.2 Download files to a microcomputer
34.6.3 Create web applications to perform file transfer
34.6.4 Run forms and reports on the web

# Unit 35: Project Management

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:** Mathematics, Communications
**RC:** CNE, NKC

| EDU: | 10 | 12 | AD |
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| PSD | | | I |
| IM | | | I |

**Competency 35.1: Manage information system project methodologies**

*Competency Builders:*

35.1.1 Define the project's contribution to business needs (ISS, NS)
35.1.2 Define the scope of the project (ISS, NS)
35.1.3 Identify stakeholders and decision makers (ISS, NS)
35.1.4 Identify escalation procedures (ISS, NS)
35.1.5 Develop task list (work breakdown structures) (ISS, NS)
35.1.6 Evaluate project requirements (ISS, NS)
35.1.7 Identify required resources and budget (ISS, NS)
35.1.8 Secure needed resources (ISS, NS)
35.1.9 Estimate time requirements (ISS, NS)
35.1.10 Develop initial project management flowchart (ISS, NS)
35.1.11 Identify interdependencies (ISS, NS)
35.1.12 Identify critical milestones (ISS, NS)
35.1.13 Evaluate risks (ISS, NS)
35.1.14 Prepare contingency plan (ISS, NS)
35.1.15 Manage the change control process (ISS, NS)
35.1.16 Track critical milestones (ISS, NS)
35.1.17 Participate in project phase review (ISS, NS)
35.1.18 Report project status (ISS, NS)
35.1.19 Utilize project management software (ISS, NS)
35.1.20 Develop a method of evaluation (ISS, NS)

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:** Mathematics
**RC:** CNE, NKC

| EDU: | 10 | 12 | AD |
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| PSD | | | I |
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**Competency 35.2: Define scope of work to achieve individual and group goals**
*Competency Builders:*
35.2.1 Assess the task's contribution to overall business needs (NS)
35.2.2 Identify size and specifics of the task (NS)
35.2.3 Formulate task sequence (NS)
35.2.4 Plan multiple tasks simultaneously (NS)
35.2.5 Identify potential problems (NS)
35.2.6 Develop contingency plans (NS)

**BIL:** Essential – ISS, NS Recommended – PSD, IM
**AC:** Communications
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| PSD | I | I | I |
| IM | | I | IR |

**Competency 35.3: Develop time and activity plan to achieve objectives**
*Competency Builders:*
35.3.1 Coordinate plan with team, cross-functional groups, or individuals (NS)
35.3.2 Formulate a task strategy (NS)
35.3.3 Prioritize tasks according to business needs (NS)
35.3.4 Manage multiple tasks simultaneously (NS)
35.3.5 Devise plan of action (NS)

**BIL:** Essential – NS Recommended – ISS, PSD, IM
**AC:** Mathematics, Communications
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| PSD | I | IR | IR |
| IM | | | I |

**Competency 35.4: Manage work processes and procedures**

*Competency Builders:*

35.4.1 Design an approach to directory organization and file naming that will support access to data (NS)
35.4.2 Analyze situation (NS)
35.4.3 Create work plan based on analysis of situation (NS)
35.4.4 Identify supplies and tools needed (NS)
35.4.5 Develop budget guidelines (NS)
35.4.6 Coordinate work processes and procedures (NS)
35.4.7 Monitor work processes and procedures (NS)
35.4.8 Evaluate work processes and procedures (NS)
35.4.9 Generate task status reports (NS)

# Unit 36: Communication

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | P | PR | PR |
| NS | P | PR | PR |
| PSD | P | PR | PR |
| IM | P | PR | PR |

**Competency 36.1: Apply communication skills**

*Competency Builders:*

36.1.1 Guide communication activities using established rules for grammar, spelling, and sentence construction
36.1.2 Follow written and/or oral instructions
36.1.3 Apply creativity in oral and written communications
36.1.4 Proofread documents
36.1.5 Interpret oral, written, and nonverbal communications
36.1.6 Evaluate audience (e.g., specific interests, level of technical knowledge)
36.1.7 Adjust communication style to fit audience (e.g., use of jargon, level of technical details)
36.1.8 Determine means of communications appropriate for given situations (e.g., telephone, meeting, electronic mail, and written communication)
36.1.9 Reinforce intended message using nonverbal communication
36.1.10 Influence listeners' perceptions through precision questioning
36.1.11 Practice active listening skills (e.g., paraphrasing)
36.1.12 Obtain needed information using questioning techniques
36.1.13 Adjust message and/or its delivery based on feedback from listeners (verbal and nonverbal)
36.1.14 Participate in group discussions and meetings
36.1.15 Assess/refine communication skills

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| ISS | P | PR | PR |
| NS | P | PR | PR |
| PSD | P | PR | PR |
| IM | P | PR | PR |

**Competency 36.2: Compose documents**
*Competency Builders:*

36.2.1 Demonstrate knowledge of the characteristics of different approaches to writing (e.g., direct, indirect, and persuasive)
36.2.2 Demonstrate knowledge of components of an effective message (e.g., clear, concise, complete, accurate, and courteous)
36.2.3 Evaluate audience
36.2.4 Gather information
36.2.5 Organize information
36.2.6 Develop outline
36.2.7 Draft document in accordance with established standards for communication
36.2.8 Verify spelling, grammar, and punctuation
36.2.9 Verify accuracy of content
36.2.10 Prepare final document

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

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**Competency 36.3: Demonstrate sensitivity in communicating with a diverse workforce**
*Competency Builders:*

36.3.1 Identify factors (e.g., culture, ethnicity, equity, special/exceptional needs) that impact communication
36.3.2 Identify strategies for successful communication with a diverse workforce
36.3.3 Determine communication style appropriate for listener(s)
36.3.4 Bridge communication styles
36.3.5 Establish guidelines for dealing with conflict

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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**Competency 36.4: Deliver oral presentations**

*Competency Builders:*

36.4.1 Prepare presentation and supporting materials (e.g., handouts, transparencies, electronic slide shows)
36.4.2 Practice presentation
36.4.3 Deliver presentation incorporating both verbal and nonverbal communication skills
36.4.4 Obtain feedback on the effectiveness of presentation

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** CCNA-Curr, CNA, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | I | P | PR |
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**Competency 36.5: Build interpersonal skills with individuals and other team members**

*Competency Builders:*

36.5.1 Analyze the interdependence of empathetic listening, synergy, and consensus building
36.5.2 Define roles within the group decision-making process
36.5.3 Apply knowledge of group dynamics
36.5.4 Promote teamwork, leadership, and empowerment
36.5.5 Identify strategies for fostering creativity
36.5.6 Recognize the effect of influence, power, and politics on communication
36.5.7 Establish negotiation guidelines

# Unit 37: Technical Writing and Documentation

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Mathematics
**RC:** CCNA-Curr, CNE, NKC

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**Competency 37.1: Evaluate technical writing requirements**

*Competency Builders:*

37.1.1 Define/prioritize communication needs (ISS, NS, PSD, IM)
37.1.2 Resolve conflicting requirements (ISS, NS, PSD, IM)
37.1.3 Specify project objectives (ISS, NS, PSD, IM)
37.1.4 Determine the size and specifics of the work to be completed (ISS, NS, PSD, IM)
37.1.5 Estimate time, materials, and capabilities needed to complete assignment (ISS, NS, PSD, IM)
37.1.6 Identify criteria for successful completion of project (ISS, NS, PSD, IM)
37.1.7 Evaluate strengths and weaknesses of completed project (ISS, NS, PSD, IM)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Mathematics, Science, Communications
**RC:** CCNA-Curr, CNA, CNE, NKC

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| PSD | I | IR | P |
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**Competency 37.2: Write technical reports**

*Competency Builders:*

37.2.1 Determine audience (ISS, NS, PSD, IM)
37.2.2 Access needed information using standard references and sources (ISS, NS, PSD, IM)
37.2.3 Identify type of report needed (ISS, NS, PSD, IM)
37.2.4 Compile relevant data (ISS, NS, PSD, IM)
37.2.5 Organize data into charts and graphs (ISS, NS, PSD, IM)
37.2.6 Analyze data (ISS, NS, PSD, IM)
37.2.7 Draw conclusions from data analysis (ISS, NS, PSD, IM)
37.2.8 Outline report (ISS, NS, PSD, IM)
37.2.9 Draft report (ISS, NS, PSD, IM)

37.2.10 Edit report (e.g., check spelling, grammar, punctuation, sentence structure, accuracy of content) (ISS, NS, PSD, IM)
37.2.11 Review report with peers (ISS, NS, PSD, IM)
37.2.12 Revise report as needed based on peer feedback (ISS, NS, PSD, IM)
37.2.13 Proofread revised report (ISS, NS, PSD, IM)
37.2.14 Present reports (ISS, NS, PSD, IM)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Mathematics, Science, Communications
**RC:** CCNA-Curr, CNA, CNE, NKC

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**Competency 37.3: Conduct technical research**
*Competency Builders:*
37.3.1 Identify target audience (ISS, NS, PSD, IM)
37.3.2 Define research questions (ISS, NS, PSD, IM)
37.3.3 Determine priorities for the information that should be gathered (ISS, NS, PSD, IM)
37.3.4 Identify potential sources of information (ISS, NS, PSD, IM)
37.3.5 Target audience/user group as a key information source (ISS, NS, PSD, IM)
37.3.6 Identify subject-matter experts (ISS, NS, PSD, IM)
37.3.7 Evaluate potential sources of information based on established criteria (e.g., affordability, relevance) (ISS, NS, PSD, IM)
37.3.8 Conduct interviews with selected human information sources (ISS, NS, PSD, IM)
37.3.9 Gather information from selected print and electronic sources (ISS, NS, PSD, IM)
37.3.10 Determine the accuracy and completeness of the information gathered (ISS, NS, PSD, IM)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Mathematics, Communications
**RC:** CCNA-Curr, CNE, NKC

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**Competency 37.4: Design technical documentation**
*Competency Builders:*

37.4.1 Define purpose of documentation (ISS, NS, PSD, IM)
37.4.2 Specify standards for documentation, including critical success criteria (ISS, NS, PSD, IM)
37.4.3 Identify delivery options (ISS, NS, PSD, IM)
37.4.4 Evaluate cost-effectiveness of each delivery option (ISS, NS, PSD, IM)
37.4.5 Select tools appropriate for task purpose (ISS, NS, PSD, IM)
37.4.6 Plan information flow (ISS, NS, PSD, IM)
37.4.7 Select writing style and tone appropriate for given documentation (ISS, NS, PSD, IM)
37.4.8 Determine level of detail needed (ISS, NS, PSD, IM)
37.4.9 Identify visuals appropriate for given documentation (ISS, NS, PSD, IM)
37.4.10 Provide feedback on design to development team/individual (ISS, NS, PSD, IM)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Mathematics, Science, Communications
**RC:** CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
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| NS | | I | P |
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**Competency 37.5: Develop technical documentation**
*Competency Builders:*

37.5.1 Determine audience (ISS, NS, PSD, IM)
37.5.2 Identify parameters (ISS, NS, PSD, IM)
37.5.3 Monitor development progress (ISS, NS, PSD, IM)
37.5.4 Ask questions (ISS, NS, PSD, IM)
37.5.5 Interpret specifications or drawings for target audience (ISS, NS, PSD, IM)
37.5.6 Record process (e.g., flowchart, step-by-step narrative) (ISS, NS, PSD, IM)
37.5.7 Record data (ISS, NS, PSD, IM)
37.5.8 Maintain test logs (ISS, NS, PSD, IM)
37.5.9 Compile cumulative reference/record (ISS, NS, PSD, IM)
37.5.10 Measure compliance with established parameters (ISS, NS, PSD, IM)

37.5.11 Verify the accuracy and validity of the information (ISS, NS, PSD, IM)
37.5.12 Select information relevant to and appropriate for the given documentation (ISS, NS, PSD, IM)
37.5.13 Organize/synthesize information (ISS, NS, PSD, IM)
37.5.14 Present content in clear and concise way (ISS, NS, PSD, IM)
37.5.15 Translate technical terminology into understandable terms (for audience) (ISS, NS, PSD, IM)
37.5.16 Employ presentation tools and techniques appropriate for the given documentation (ISS, NS, PSD, IM)
37.5.17 Obtain feedback on the information provided and its technical accuracy (ISS, NS, PSD, IM)
37.5.18 Draft procedures (ISS, NS, PSD, IM)
37.5.19 Test documentation for usability (ISS, NS, PSD, IM)
37.5.20 Edit documentation for readability, grammar, and usage (ISS, NS, PSD, IM)
37.5.21 Publish documentation (ISS, NS, PSD, IM)
37.5.22 Maintain required logs (ISS, NS, PSD, IM)
37.5.23 Track expenses involved (ISS, NS, PSD, IM)

# Unit 38: Customer Relations

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

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**Competency 38.1 Build customer relations**

*Competency Builders:*

38.1.1 Identify organizations' products and services (including own strengths as a sales agent)
38.1.2 Recognize the importance of all customers to the business
38.1.3 Determine customers' individual needs
38.1.4 Project a professional business image (e.g., appearance, voice, grammar, word usage, enunciation, nonverbal communication)
38.1.5 Interact with customers and colleagues in a professional manner (e.g., prompt, friendly, courteous, respectful, helpful, knowledgeable, understandable)
38.1.6 Comply with established business protocols and company policies
38.1.7 Communicate company policies to customers
38.1.8 Handle merchandise returns in accordance with customer service policy
38.1.9 Handle customer complaints in accordance with customer service policy
38.1.10 Facilitate customer service through the maintenance of key information systems
38.1.11 Follow through on commitments made to customers (e.g., special orders, delivery specifications, new items)
38.1.12 Maintain customer base

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** CCNA-Curr, MOUS, CNA, CNE, NKC

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| PSD | I | P | |
| IM | I | P | |

**Competency 38.2: Perform scheduling functions to meet customers needs**

*Competency Builders:*

38.2.1 Create calendars/schedules
38.2.2 Maintain appointment calendars
38.2.3 Process requests for appointments

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| 38.2.4 | Verify appointments |
| 38.2.5 | Notify customers of changes in schedule |
| 38.2.6 | Manage scheduling conflicts |
| 38.2.7 | Document results |

# Unit 39: Economic and Business Concepts

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:** CNE

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**Competency 39.1: Characterize the nature of business**

*Competency Builders:*

39.1.1 Identify types of business organizations and functions (NS)
39.1.2 Demonstrate knowledge of the components of a business plan (NS)
39.1.3 Identify business reporting and information flow (NS)
39.1.4 Identify the ways in which organizational functions are interdependent (NS)
39.1.5 Identify types of communication channels (e.g., formal, informal) (NS)
39.1.6 Determine how business activities interface with data processing functions (NS)
39.1.7 Define stakeholder relationships (e.g., customers, employees, shareholders, and suppliers) (NS)
39.1.8 Define the role of strategic planning in business (NS)
39.1.9 Identify generally accepted business ethics (NS)
39.1.10 Differentiate between ethics and legality (NS)

**BIL:** Essential – IM Recommended – ISS, NS, PSD
**AC:** Mathematics
**RC:**

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| PSD | I | P | |
| IM | I | P | |

**Competency 39.2: Interpret economic concepts**

*Competency Builders:*

39.2.1 Demonstrate knowledge of basic economic concepts
39.2.2 Interpret economic terminology
39.2.3 Identify the characteristics of a free enterprise system
39.2.4 Compare/contrast various forms of competition (e.g., pure competition, oligopoly monopoly)
39.2.5 Demonstrate knowledge of the cyclical nature of the economy (e.g., unemployment, recession, inflation, balance of trade, and budget deficits)
39.2.6 Identify the effects of public and private economic activity on the business sector

39.2.7 Identify how world economic/geographic factors (e.g., concepts, boundaries, barriers, cultures, and politics) affect the balance of trade and import/export processes
39.2.8 Compare/contrast foreign economic and political systems
39.2.9 Compare/contrast international and U.S. banking practices
39.2.10 Apply economic concepts to the global market

**BIL:** Essential – IM Recommended – ISS, NS, PSD
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 39.3: Interpret marketing concepts**
*Competency Builders:*
39.3.1 Demonstrate knowledge of basic marketing concepts (internal and external) (IM)
39.3.2 Interpret marketing terminology (IM)
39.3.3 Analyze ways in which businesses compete with one another (IM)
39.3.4 Identify target markets (IM)
39.3.5 Analyze internal and external markets (IM)
39.3.6 Determine appropriate customer service levels (IM)
39.3.7 Determine strategies for relating to different types of customers (IM)
39.3.8 Determine strategies for monitoring internal and external customer needs (IM)
39.3.9 Determine alternative marketing strategies (IM)
39.3.10 Select marketing concepts appropriate to identified markets (IM)

**BIL:** Essential – IM Recommended – ISS, NS, PSD
**AC:** Mathematics, Communications
**RC:** CNE

| EDU: | 10 | 12 | AD |
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| PSD | | I | P |
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**Competency 39.4: Clarify management concepts**
*Competency Builders:*
39.4.1 Demonstrate knowledge of the major functions of management (IM)
39.4.2 Identify the activities that are part of each management function (IM)
39.4.3 Compare/contrast management functions (IM)

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| 39.4.4 | Analyze management styles (IM) |
| 39.4.5 | Assess the role of authority, accountability, and responsibility in task accomplishment (IM) |
| 39.4.6 | Demonstrate knowledge of problem-solving steps and techniques (IM) |
| 39.4.7 | Demonstrate knowledge of decision-making skills and techniques (IM) |
| 39.4.8 | Demonstrate knowledge of critical thinking skills and techniques (IM) |
| 39.4.9 | Demonstrate knowledge of past, current, and emerging management trends (e.g., quality circles, suggestion systems, total quality management, risk management, total preventive maintenance, continuous improvement, time management, team building, inventory management, flexible time) (IM) |

# Unit 40: Financial Management Functions

**BIL:** Essential – ISS, IM Recommended – NS, PSD
**AC:**
**RC:** CNE

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| PSD | | I | P |
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**Competency 40.1: Demonstrate knowledge of management's role in operating a business**
*Competency Builders:*

40.1.1 Recognize the importance of organizational skills (ISS, IM)
40.1.2 Compare/contrast specific management techniques (ISS, IM)
40.1.3 Recognize the importance of time management (ISS, IM)
40.1.4 Identify the benefits of membership in professional/trade associations (ISS, IM)
40.1.5 Identify the characteristics and functions of a professional support system (ISS, IM)

**BIL:** Essential – PSD Recommended – ISS, NS, IM
**AC:** Communications
**RC:**

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**Competency 40.2: Apply basic accounting concepts and principles**
*Competency Builders:*

40.2.1 Demonstrate knowledge of basic accounting principles and applications (PSD)
40.2.2 Interpret accounting terminology (PSD)
40.2.3 Utilize financial control procedures (PSD)
40.2.4 Utilize record-keeping procedures for specific business and economic applications (PSD)
40.2.5 Select computer accounting applications (PSD)
40.2.6 Evaluate periodic reporting procedures (PSD)

**BIL:** Essential – PSD Recommended – ISS, NS, IM
**AC:** Mathematics
**RC:**

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**Competency 40.3: Perform basic accounting functions**
*Competency Builders:*
40.3.1 Analyze transactions (PSD)
40.3.2 Record transactions (PSD)
40.3.3 Monitor expense accounts (PSD)
40.3.4 Prepare budgets (PSD)
40.3.5 Process purchases (PSD)

**BIL:** Essential – PSD Recommended – ISS, IM
**AC:** Mathematics
**RC:**

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**Competency 40.4: Prepare financial statements**
*Competency Builders:*
40.4.1 Prepare balance sheets (PSD)
40.4.2 Prepare income statements (PSD)
40.4.3 Interpret financial statements (PSD)
40.4.4 Prepare cash-flow statements (PSD)
40.4.5 Prepare change-in-equity statements (PSD)

**BIL:** Recommended – ISS, NS, PSD, IM
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| PSD | I | IR | P |
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**Competency 40.5: Analyze financial performance**
*Competency Builders:*
40.5.1 Interpret balance sheets
40.5.2 Interpret income statements
40.5.3 Perform cash-flow analyses
40.5.4 Interpret cash-flow analysis statements
40.5.5 Prepare break-even analyses
40.5.6 Prepare budgets
40.5.7 Prepare comparative financial statements
40.5.8 Prepare cost and revenue analyses

**BIL:** Essential – ISS Recommended – IM
**AC:** Mathematics, Communications
**RC:**

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| ISS | | I | P |
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**Competency 40.6: Use financial statements to make business decisions**
*Competency Builders:*
40.6.1 Prepare budgets based on cost and revenue analyses (ISS)
40.6.2 Calculate profitability ratios from financial statements (ISS)
40.6.3 Interpret cash-flow analysis statements (ISS)
40.6.4 Document the impact of financial analysis on the strategic planning process (ISS)
40.6.5 Revise short-term and strategic plans based on financial analyses (ISS)

# Unit 41: International Business

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 41.1: Develop communication skills for an international audience**
*Competency Builders:*

41.1.1 Identify the customs of the recipient that impact communication (ISS, NS, PSD, IM)
41.1.2 Find answers to questions related to international communications using available human, print, and electronic sources (ISS, NS, PSD, IM)
41.1.3 Prepare documents in correct style for international communications (ISS, NS, PSD, IM)

**BIL:** Recommended – ISS, IM
**AC:** Science
**RC:**

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**Competency 41.2: Analyze the cultural demographics of major world regions**
*Competency Builders:*

41.2.1 Identify the major cultural groups of the United States
41.2.2 Compare/contrast cultural groups between countries
41.2.3 Compare/contrast cultural groups within a country
41.2.4 Identify the major cultural groups of East Asia
41.2.5 Identify the major cultural groups of the Asian Sub-continent
41.2.6 Identify the major cultural groups of the Middle East
41.2.7 Identify the major cultural groups of Sub-Saharan Africa
41.2.8 Identify the major cultural groups of Eastern Europe
41.2.9 Identify the major cultural groups of Western Europe
41.2.10 Identify the major cultural groups of Latin America

**BIL:** Recommended – ISS, IM
**AC:**
**RC:**

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**Competency 41.3: Identify cultural customs that may impact international business**
*Competency Builders:*

41.3.1 Identify cultural differences in food, dress, and social behaviors
41.3.2 Compare the use of calendars in different societies
41.3.3 Identify major holidays celebrated by different cultures and how they are celebrated
41.3.4 Identify the importance of gift-giving in various cultures

**BIL:** Recommended – ISS, PSD, IM
**AC:**
**RC:**

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**Competency 41.4: Analyze the impact of the cultural environment on business**
*Competency Builders:*

41.4.1 Demonstrate knowledge of how culture influences business operations
41.4.2 Identify social and cultural sectors that affect the conduct of business
41.4.3 Compare/contrast business practices in different cultures
41.4.4 Compare/contrast the steps used to receive business visitors in different countries
41.4.5 Compare/contrast the negotiation tactics and decision-making processes used in various cultures
41.4.6 Compare/contrasts types of business relationships maintained in various cultures
41.4.7 Compare/contrast business entertainment practices in various parts of the world
41.4.8 Identify cultural attitudes and practices in the U.S. that could inhibit successful business operations in another country
41.4.9 Determine modifications to American business practices required for success in the global marketplace

# Unit 42: Management and Supervision

**BIL:** Essential – ISS, NS, PSD
**AC:** Mathematics, Science
**RC:** A+, CCNA-Curr, CNA, CNE, NKC

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| ISS | I | P | PR |
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**Competency 42.1: Maintain a safe working environment**

*Competency Builders:*

42.1.1 Demonstrate knowledge of the relationship between health, safety, and productivity
42.1.2 Identify health and safety standards established by government agencies
42.1.3 Access needed safety information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, and flowcharts)
42.1.4 Establish preventive measure for dealing with the main causes of accidents in the facility
42.1.5 Establish preventive measures for dealing with the main causes of health problems in the facility
42.1.6 Establish preventive measures for dealing with violations of personnel security
42.1.7 Ensure compliance with government and/or company rules and regulations related to health and safety
42.1.8 Ensure maintenance of a clean work area
42.1.9 Perform safety audits and inspections
42.1.10 Solve safety problems using problem solving, decision-making, and critical thinking strategies

**BIL:** Essential – ISS Recommended – NS, PSD
**AC:** Communications
**RC:** CNA, CNE

| EDU: | 10 | 12 | AD |
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| NS | I | IR | IR |
| PSD | | I | IR |

**Competency 42.2: Guide progress in assigned areas of responsibility/accountability**

*Competency Builders:*

42.2.1 Set short- and long-term goals for assigned areas of responsibility/accountability (ISS)
42.2.2 Demonstrate commitment to established goals and vision (ISS)
42.2.3 Obtain support for goals (ISS)
42.2.4 Provide support for goals (ISS)

42.2.5 Monitor goal achievement (ISS)
42.2.6 Adjust goals (ISS)
42.2.7 Communicate goal achievement (ISS)
42.2.8 Provide recognition for goal achievement (ISS)

**BIL:** Recommended – ISS
**AC:** Communications
**RC:**

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**Competency 42.3: Perform staffing functions**

*Competency Builders:*

42.3.1 Develop plans and procedures for identifying staffing needs
42.3.2 Identify staffing needs in accordance with plans
42.3.3 Develop job descriptions
42.3.4 Develop hiring and promotion policies and procedures in compliance with state and federal employment laws
42.3.5 Establish guidelines for selecting the most qualified person for a specific position
42.3.6 Comply with state and federal employment laws and company hiring policies and procedures
42.3.7 Identify resources for locating candidates
42.3.8 Recruit candidates
42.3.9 Identify most appropriate candidates for position in accordance with established guidelines
42.3.10 Interview candidates for position
42.3.11 Follow up on information provided on job applications
42.3.12 Recommend or select applicants for employment
42.3.13 Orient new employees
42.3.14 Maintain personnel records
42.3.15 Comply with labor contracts
42.3.16 Comply with Workers' Compensation guidelines
42.3.17 Provide for unconventional work schedules (e.g., flextime, shared positions)
42.3.18 Identify additional or alternative employee benefits that the company might consider furnishing to employees

**BIL:** Recommended – ISS
**AC:** Communications
**RC:**

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**Competency 42.4: Manage employee performance**

*Competency Builders:*

42.4.1 Apply management/leadership style appropriate for situation
42.4.2 Clarify roles and relationships using organizational charts
42.4.3 Communicate performance expectations
42.4.4 Clarify company policies and procedures
42.4.5 Create/maintain an environment supportive of productivity
42.4.6 Establish office procedures
42.4.7 Maintain office procedure manual(s)
42.4.8 Monitor employee performance
42.4.9 Maintain performance records
42.4.10 Document personnel issues
42.4.11 Evaluate employee performance
42.4.12 Provide employees with constructive criticism and feedback
42.4.13 Counsel employees
42.4.14 Discipline employees
42.4.15 Make recommendations based on employee performance (e.g., transfer, promotion, or dismissal)
42.4.16 Manage the change process (e.g., for right-sizing, technological updating, globalization, retraining)
42.4.17 Adhere to company policies and federal laws governing discrimination and harassment
42.4.18 Demonstrate sensitivity to diversity, including differences in gender, culture, race, language, physical and mental challenges, and family structures
42.4.19 Apply knowledge of motivational theory in selecting management techniques

**BIL:** Recommended – ISS
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 42.5: Provide employee development activities**

*Competency Builders:*

42.5.1 Analyze employee development needs (e.g., retraining, updating, stress management)
42.5.2 Select development strategies designed to meet individual and group needs
42.5.3 Identify the benefits of employee development activities offered outside the organization

42.5.4 Secure personnel resources, materials, and equipment needed for employee development activities
42.5.5 Monitor employee development activities
42.5.6 Keep employees informed about development opportunities
42.5.7 Encourage employee participation in development activities
42.5.8 Evaluate employee progress
42.5.9 Provide feedback to employees concerning their progress
42.5.10 Provide formal and informal recognition for employee development

**BIL:** Recommended – ISS
**AC:** Mathematics, Science, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 42.6: Perform strategic planning functions**
*Competency Builders:*
42.6.1 Guide the planning process using problem-solving, decision-making, and critical thinking strategies
42.6.2 Analyze needs
42.6.3 Secure needed information through research
42.6.4 Develop goals and objectives
42.6.5 Prioritize goals and objectives
42.6.6 Develop action plan for achieving objectives
42.6.7 Project trends and outcomes using forecasting techniques
42.6.8 Prepare budgets
42.6.9 Analyze budgets
42.6.10 Develop strategic plan

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 42.7: Perform routine management functions**
*Competency Builders:*
42.7.1 Guide the management process using problem-solving, decision-making, and critical thinking strategies
42.7.2 Develop management objectives
42.7.3 Conduct task analyses
42.7.4 Create/maintain organizational and/or departmental charts

42.7.5 Maintain procedure manuals
42.7.6 Solve space utilization problems using math and problem-solving skills
42.7.7 Follow the chain of command
42.7.8 Maintain confidentiality
42.7.9 Clarify company policies and procedures
42.7.10 Communicate cost-containment factors
42.7.11 Monitor budget activity
42.7.12 Prepare managerial reports
42.7.13 Analyze daily production reports
42.7.14 Represent the organization to the public

**BIL:** Recommended – ISS
**AC:** Mathematics, Communications
**RC:**

| **EDU:** | 10 | 12 | AD |
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**Competency 42.8: Manage work flow and operations**

*Competency Builders:*

42.8.1 Plan physical layout and work flow
42.8.2 Illustrate business or job procedures/operations using flowcharts
42.8.3 Prioritize work
42.8.4 Establish/maintain operating policies and procedures
42.8.5 Establish/maintain production standards
42.8.6 Establish/maintain linkages with other departments
42.8.7 Systematize work
42.8.8 Delegate work
42.8.9 Communicate operating policies and procedures, priorities, linkages, and standards to others
42.8.10 Provide work assignments and instructions
42.8.11 Monitor progress
42.8.12 Solve work flow/operations problems using problem-solving, decision-making, and critical thinking strategies
42.8.13 Prepare productivity reports
42.8.14 Communicate contents of productivity reports to others in accordance with company procedures

**BIL:** Essential – NS, PSD Recommended – ISS
**AC:** Communications
**RC:**

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**Competency 42.9: Conduct meetings**
*Competency Builders:*
42.9.1 Plan meeting (PSD)
42.9.2 Set agenda (PSD)
42.9.3 Schedule meeting (PSD)
42.9.4 Reserve meeting room (PSD)
42.9.5 Invite appropriate personnel (PSD)
42.9.6 Identify need for outside speakers (PSD)
42.9.7 Assign someone to take minutes (PSD)
42.9.8 Make introductions (PSD)
42.9.9 Invite questions, comments, and group participation (PSD)
42.9.10 Determine appropriate action, time frame, and person accountable for identified tasks (PSD)
42.9.11 Monitor time (PSD)
42.9.12 Publish minutes in timely manner (PSD)

**BIL:** Essential – PSD Recommended – ISS
**AC:** Communications
**RC:** CNA, CNE

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**Competency 42.10: Maintain company security**
*Competency Builders:*
42.10.1 Access needed information using company references (PSD)
42.10.2 Plan security procedures in accordance with business ethics (PSD)
42.10.3 Communicate security procedures internally (PSD)
42.10.4 Ensure compliance with security procedures (PSD)
42.10.5 Document security procedures (PSD)
42.10.6 Perform security checks (PSD)
42.10.7 Correct security problems (PSD)

**BIL:** Essential – NS Recommended – ISS
**AC:**
**RC:**

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**Competency 42.11: Support the company's social and community involvement**
*Competency Builders:*

42.11.1 Propose environmental, educational, and community needs and social issues on which to focus company support
42.11.2 Select issues on which to focus company support
42.11.3 Participate in social and/or community activities
42.11.4 Encourage staff involvement
42.11.5 Recognize the importance of the company's social and community relationships and their effects on the company

# Unit 43: Business Law, Ethics and Legal Issues

**BIL:** Essential – IM Recommended – ISS, NS, PSD
**AC:** Communications
**RC:**

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**Competency 43.1: Demonstrate knowledge of legal rights and responsibilities**

*Competency Builders:*

43.1.1 Identify major types of laws (IM)

43.1.2 Differentiate between crimes and torts (e.g., terminology, conceptual development) (IM)

43.1.3 Differentiate between criminal and civil law (IM)

43.1.4 Differentiate between state and federal court systems (IM)

43.1.5 Demonstrate knowledge of the court system procedural process (e.g., how a case goes to trial) (IM)

43.1.6 Determine the practical implications of lawsuits in terms of good will, client relations, the bottom line, diversion of company resources, cash flow and accounts receivable (IM)

43.1.7 Demonstrate knowledge of basic business law concepts (IM)

43.1.8 Relate current laws and regulations to company contracts, policies, and procedures (IM)

43.1.9 Demonstrate knowledge of legal terminology (IM)

43.1.10 Establish procedures for maintaining the confidentiality of client information (IM)

**BIL:** Recommended – ISS, NS, PSD, IM
**AC:**
**RC:**

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**Competency 43.2: Demonstrate knowledge of labor law**

*Competency Builders:*

43.2.1 Demonstrate knowledge of the employment-at-will concept

43.2.2 Demonstrate knowledge of key laws related to employment discrimination (e.g., Title VII of the Civil Rights Act of 1964, Age Discrimination in Employment Act

of 1967, Equal Pay Act of 1963, Americans with Disabilities Act, statutory protection against retaliation)

43.2.3 Demonstrate knowledge of key agencies related to employment discrimination (e.g., Equal Employment Opportunity Commission, Labor Relations Board, Civil Service Commission)

43.2.4 Demonstrate knowledge of key concepts related to employment discrimination (e.g., systematic/systemic discrimination, disparate impact/treatment & quid pro quo, exceptions/justifications for unequal treatment)

43.2.5 Demonstrate knowledge of the concept of reasonable accommodation

43.2.6 Identify the key characteristics of Social Security and other retirement systems

43.2.7 Identify the rights and responsibilities of parties to an employment contract

43.2.8 Identify state and federal laws dealing with employment

43.2.9 Identify protections available to employees

43.2.10 Identify rules of law affecting minors

43.2.11 Demonstrate knowledge of basic laws relating to working conditions, wages and hours, civil rights, social security, disability, and unemployment

43.2.12 Demonstrate knowledge of the role of unions in business

**BIL:** Essential – IM Recommended – ISS, NS, PSD
**AC:** Communications
**RC:**

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**Competency 43.3: Demonstrate knowledge of contract law**

*Competency Builders:*

43.3.1 Demonstrate knowledge of the key characteristics of contracts and/or legal documents (IM)

43.3.2 Analyze the elements of a contract for validity (i.e., offer, acceptance, considerations, and subject matter) (IM)

43.3.3 Differentiate between types of contracts (e.g., oral, written, implied) (IM)

43.3.4 Differentiate between transferable and nontransferable contracts (IM)

43.3.5 Identify means of discharging contracts (substantial vs. specific performance) (IM)

43.3.6 Identify remedies available for a breach of contract (legal and nonlegal) (IM)

**BIL:** Essential – ISS, NS, PSD, IM
**AC:** Communications
**RC:**

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**Competency 43.4: Demonstrate knowledge of intellectual property rights covered by intellectual law**

*Competency Builders:*

43.4.1 Demonstrate knowledge of the various forms of intellectual property rights (e.g., copyright, patent, trademark, trade secrets)
43.4.2 Define *plagiarism*
43.4.3 Define *authorship*
43.4.4 Define *work made for hire*
43.4.5 Define *fair use*
43.4.6 Demonstrate knowledge of court cases related to intellectual property rights
43.4.7 Demonstrate knowledge of First Amendment rights
43.4.8 Demonstrate knowledge of software licensing issues
43.4.9 Demonstrate knowledge of how to obtain a copyright
43.4.10 Demonstrate knowledge of how to obtain a patent
43.4.11 Demonstrate knowledge of how to obtain a trademark
43.4.12 Identify the perils in acquiring content rights
43.4.13 Identify the rights granted under copyright, patent, and trademark
43.4.14 Identify the rights related to electronic imagery
43.4.15 Identify the liability for copyright infringement
43.4.16 Identify the liability for invasion of privacy
43.4.17 Identify the liability for slander and libel
43.4.18 Demonstrate knowledge of confidentiality issues and their liability implications
43.4.19 Demonstrate knowledge of the characteristics of warranties

**BIL:** Essential – ISS, NS, PSD, IM
**AC:**
**RC:** CCNA-Curr

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**Competency 43.5: Demonstrate knowledge of social, ethical, and legal issues in the information technology field**

*Competency Builders:*

43.5.1 Analyze the social implications of decisions made and actions taken as an information technology professional (PSD)

43.5.2 Demonstrate knowledge of the ethical issues that face information technology professionals (PSD)

43.5.3 Demonstrate knowledge of the legal issues that face information technology professionals (PSD)

# Unit 44: Quality Assurance

**BIL:** Essential – ISS, PSD Recommended – NS, IM
**AC:** Mathematics, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 44.1: Demonstrate basic knowledge of quality assurance**

*Competency Builders:*

44.1.1 Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000) (PSD)

44.1.2 Demonstrate knowledge of changes brought about by quality leaders in the world (PSD)

44.1.3 Demonstrate knowledge of the ISO 9000 process (PSD)

44.1.4 Demonstrate knowledge of the standards/requirements for the Baldridge award (PSD)

44.1.5 Demonstrate knowledge of quality management terminology (PSD)

44.1.6 Identify the role of quality within the organization (PSD)

44.1.7 Identify the features and benefits of quality planning (PSD)

44.1.8 Demonstrate knowledge of the control devices used in functional areas (e.g., SPC, equipment) (PSD)

44.1.9 Demonstrate knowledge of the relationship among organizational structures, policies, procedures, and quality assurance (PSD)

44.1.10 Identify internal and external customers (PSD)

44.1.11 Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs (PSD)

44.1.12 Differentiate between prevention and detection (PSD)

44.1.13 Differentiate between variable and attribute data (PSD)

44.1.14 Identify types of control charts (PSD)

44.1.15 Demonstrate knowledge of how statistical techniques are used to control quality (e.g., SPC, DOE, CR) (PSD)

**BIL:** Recommended – ISS, NS, PSD, IM
**AC:** Mathematics
**RC:**

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**Competency 44.2: Employ quality tools**

*Competency Builders:*

44.2.1 Demonstrate knowledge of the characteristics and functions of available quality tools
44.2.2 Prepare affinity diagrams
44.2.3 Prepare attributes control charts: nonconforming items
44.2.4 Prepare attributes control charts: nonconformities
44.2.5 Prepare a cause-and-effect diagrams
44.2.6 Prepare check sheets
44.2.7 Prepare flowcharts
44.2.8 Prepare Histograms
44.2.9 Prepare Pareto diagrams
44.2.10 Prepare relations diagrams
44.2.11 Prepare run charts
44.2.12 Prepare scatter diagrams
44.2.13 Prepare systematic diagrams
44.2.14 Prepare variables control charts: N>1, N=1
44.2.15 Interpret charts
44.2.16 Prepare operational definitions
44.2.17 Perform force-field analyses
44.2.18 Employ the Nominal Group Technique
44.2.19 Perform sampling
44.2.20 Select quality tool(s) appropriate to situation

**BIL:** Recommended – ISS, PSD, IM
**AC:** Mathematics
**RC:** CCNA-Curr

| EDU: | 10 | 12 | AD |
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| ISS | | I | IR |
| PSD | | I | IR |
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**Competency 44.3: Apply knowledge of quality cost implications**

*Competency Builders:*

44.3.1 Establish cost/quality objectives
44.3.2 Classify costs (e.g., direct and indirect, fixed and variable, methods and standards)
44.3.3 Classify quality costs (e.g., prevention, evaluation, pre-delivery failure, post-delivery failure)
44.3.4 Interpret quality cost reports
44.3.5 Establish guidelines for liability prevention
44.3.6 Identify safety terms of product
44.3.7 Identify safety responsibility within organization
44.3.8 Differentiate between expressed and implied warranty
44.3.9 Differentiate between warranty and product liability
44.3.10 Demonstrate knowledge of the role of warranties in contract law

**BIL:** Essential – ISS, PSD, IM Recommended – NS
**AC:** Mathematics, Communications
**RC:** CCNA-Curr

| EDU: | 10 | 12 | AD |
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**Competency 44.4: Produce a quality product**

*Competency Builders:*

44.4.1 Design product (e.g., using brainstorming, thumbnail sketches, rendering) (ISS, PSD, IM)
44.4.2 Consider customer satisfaction in determining product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation) (ISS, PSD, IM)
44.4.3 Consider reliability factors (e.g., cost, human, producibility) (PSD, IM)
44.4.4 Achieve reliability through maintainability, good design, design simplification, and design redundancy (PSD, IM)
44.4.5 Recognize the relationship of maintainability and reliability (PSD, IM)
44.4.6 Test products for reliability (PSD, IM)
44.4.7 Align cost components with quality objectives

44.4.8 Classify quality costs (e.g., preventive, evaluation, pre-delivery failures, post-delivery failures)

44.4.9 Initiate predictive maintenance procedures

**BIL:** Recommended – ISS, NS, PSD, IM
**AC:** Mathematics, Science, Communications
**RC:**

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**Competency 44.5: Develop interdepartmental relationships to support quality assurance**

*Competency Builders:*

44.5.1 Recognize need for total commitment to assuring quality (whole company)

44.5.2 Select quality improvement team model

44.5.3 Establish project selection criteria

44.5.4 Determine project implementation cycle

44.5.5 Determine project evaluation procedures

44.5.6 Maintain continuous improvement

44.5.7 Investigate future trends in experiment design

44.5.8 Investigate future trends in predictive maintenance

# Unit 45: Training Products

**BIL:** Recommended – IM
**AC:**
**RC:**

| EDU: | 10 | 12 | AD |
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| IM | | | P |

**Competency 45.1: Demonstrate knowledge of developing a training product**

*Competency Builders:*

45.1.1 Differentiate between training needs and development needs
45.1.2 Demonstrate knowledge of the major characteristics of adult learners
45.1.3 Identify methods of product delivery (e.g., Internet, CD-ROM, Audio/Video)

**BIL:** Recommended – IM
**AC:** Mathematics, Science, Communications
**RC:**

| EDU: | 10 | 12 | AD |
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| IM | | | P |

**Competency 45.2: Develop a training product**

*Competency Builders:*

45.2.1 Analyze the audience
45.2.2 Develop training objectives
45.2.3 Employ sound instructional design principles
45.2.4 Employ a variety of media in presenting training
45.2.5 Evaluate training effectiveness

# Unit 46: Statistics

**BIL:** Recommended – ISS, NS, PSD
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
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| PSD | I | IR | IR |

**Competency 46.1: Demonstrate knowledge of the role of statistics and probability in business situations**

*Competency Builders:*

46.1.1 Identify the role of statistical methods in decision making
46.1.2 Recognize the pervasive use of probability in the real world
46.1.3 Demonstrate knowledge of how to make predictions based on exponential or theoretical probabilities
46.1.4 Establish procedures for the systematic collection, organization, and use of data in business situations
46.1.5 Recognize the importance of using tables, charts, and graphs to organize and present data

**BIL:** Recommended – ISS, NS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 46.2: Make frequency distributions**

*Competency Builders:*

46.2.1 Demonstrate knowledge of the characteristics and uses of grouped and ungrouped frequency distributions
46.2.2 Make ungrouped frequency distributions using raw data
46.2.3 Make grouped frequency distributions using raw data
46.2.4 Interpret frequency distributions

**BIL:** Recommended – ISS, NS, PSD
**AC:** Mathematics, Communications
**RC:** MOUS

| EDU: | 10 | 12 | AD |
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| NS | | I | IR |
| PSD | I | P | |

**Competency 46.3: Present data graphically**

*Competency Builders:*

46.3.1 Demonstrate knowledge of the characteristics and uses of various tools for presenting data graphically
46.3.2 Prepare line charts/frequency polygons
46.3.3 Interpret line charts/frequency polygons
46.3.4 Prepare bar charts/histograms
46.3.5 Interpret bar charts/histograms

**BIL:** Recommended – ISS, NS, PSD
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | I | P | PR |
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| PSD | I | IR | P |

**Competency 46.4: Apply measures of central tendency**

*Competency Builders:*

46.4.1 Define *mean*, *median*, and *mode*
46.4.2 Compute means, medians, and modes
46.4.3 Interpret measures of central tendency
46.4.4 Determine when and how to use measures of central tendency in the solution of business problems

**BIL:** Recommended – ISS, NS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
| NS | | I | IR |

**Competency 46.5: Explain measures of dispersion**

*Competency Builders:*

46.5.1 Define *variance, average deviation, standard deviation,* and *coefficient of variation*

46.5.2 Compute variance average deviations, standard deviations, and coefficients of variation

46.5.3 Interpret measures of dispersion

46.5.4 Determine when and how to use measures of dispersion in the solution of business problems

**BIL:** Recommended – ISS, NS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 46.6: Solve probability problems**

*Competency Builders:*

46.6.1 Define *joint, marginal,* and *conditional probabilities*

46.6.2 Solve joint probability problems using addition, multiplication permutation, and combination formulas

46.6.3 Solve marginal probability problems using addition, multiplication permutation, and combination formulas

46.6.4 Solve conditional probability problems using additions, multiplication permutation, and combination formulas

**BIL:** Recommended – ISS, NS
**AC:** Mathematics
**RC:**

| EDU: | 10 | 12 | AD |
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| ISS | | I | P |
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**Competency 46.7: Apply binomial and normal probability distributions**
*Competency Builders:*
46.7.1 Demonstrate knowledge of the characteristics and uses of normal probability distributions
46.7.2 Make binomial probability distributions
46.7.3 Make normal probability distributions

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 46.8: Demonstrate knowledge of statistical inference**
*Competency Builders:*
46.8.1 Demonstrate knowledge of the purposes of sampling
46.8.2 Demonstrate knowledge of standard methods for selecting a sample
46.8.3 Select a sample using an appropriate method
46.8.4 Demonstrate knowledge of the characteristics and uses of hypothesis testing
46.8.5 State a hypothesis
46.8.6 Test a hypothesis

# Unit 47: Basic Electricity

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Science
**RC:** A+

| EDU: | 10 | 12 | AD |
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**Competency 47.1: Demonstrate an understanding of electrical fundamentals**

*Competency Builders:*

47.1.1 Identify electrical components and schematic symbols
47.1.2 Demonstrate knowledge of the color codes and symbols used to identify electrical components/values
47.1.3 Demonstrate knowledge of basic atomic structure and its relationship to electricity
47.1.4 Demonstrate knowledge of the relationship between electrical and magnetic properties
47.1.5 Demonstrate knowledge of the electrical and magnetic properties of a magnet
47.1.6 Demonstrate knowledge of the photoelectric effect
47.1.7 Demonstrate knowledge of the thermocouple and Peltier effects
47.1.8 Demonstrate knowledge of electrical static change and the role of friction
47.1.9 Follow electrostatic discharge (ESD) preventive procedures
47.1.10 Identify sources of electricity
47.1.11 Demonstrate knowledge of the principles and operation of electrochemical supplies
47.1.12 Demonstrate knowledge of the relationship of voltage, current, resistance, power, and energy
47.1.13 Apply Ohm's law
47.1.14 Apply Kirchhoff's laws
47.1.15 Apply power formulas
47.1.16 Solve electronic unit problems using metric units

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Science
**RC:** A+

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**Competency 47.2: Demonstrate knowledge of operating the various types of equipment used to test/measure DC circuits, AC circuits, solid-state devices, digital circuits, analog circuits, and microprocessors**

*Competency Builders:*

47.2.1 Demonstrate knowledge of the function and operation of an analog volt-ohm-meter (AVOM)
47.2.2 Demonstrate knowledge of the function and operation of a digital volt-ohm-meter (DVOM)
47.2.3 Demonstrate knowledge of the function and operation of a clamp-on amp meter
47.2.4 Demonstrate knowledge of the function and operation of oscilloscopes
47.2.5 Demonstrate knowledge of the function and operation of a logic probe and logic analyzer
47.2.6 Demonstrate knowledge of the function and operation of a power monitor
47.2.7 Demonstrate knowledge of the function and operation of a signal generator
47.2.8 Demonstrate knowledge of the function and operation of a spectrum analyzer
47.2.9 Demonstrate knowledge of the function and operation of an AC/DC hi-pot
47.2.10 Demonstrate knowledge of the function and operation of a time-domain reflectometer (TDR)
47.2.11 Demonstrate knowledge of the function and operation of a megger
47.2.12 Demonstrate knowledge of the function and operation of a curve tracer/analogger
47.2.13 Measure properties of circuits using electrical test/measurement equipment
47.2.14 Troubleshoot a multicomponent electrical circuit using electrical test/measurement equipment

**BIL:** Recommended – ISS
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
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**Competency 47.3: Demonstrate proficiency in working with DC circuits**

*Competency Builders:*

47.3.1 Compute conductance of conductors and insulators
47.3.2 Measure resistance and current of conductors and insulators
47.3.3 Measure properties of a DC circuit using an analog volt-ohm-meter (AVOM) and digital volt-ohm-meter (DVOM)
47.3.4 Build series, parallel, and combination circuits
47.3.5 Build bridge circuits

47.3.6 Build voltage divider circuits (loaded and unloaded)
47.3.7 Compute voltage divider circuits (loaded and unloaded)
47.3.8 Demonstrate knowledge of maximum power transfer theory and impedance matching
47.3.9 Demonstrate knowledge of the electromagnetic properties of circuits and devices
47.3.10 Demonstrate knowledge of the physical and electrical characteristics of capacitors and inductors
47.3.11 Define resistive-capacitive (RC) and resistive-inductive (RL) time constants (TC)
47.3.12 Compute RC and RL time constants
47.3.13 Demonstrate knowledge of transient and steady-state behavior of resistive-capacitive (RC) and inductive-capacitive (LC) circuits
47.3.14 Operate power supplies for DC circuits
47.3.15 Measure current, voltage, and resistance in DC circuits
47.3.16 Build a simple DC generator
47.3.17 Build a simple DC motor
47.3.18 Demonstrate knowledge of the principles of solid-state switching devices
47.3.19 Solve algebraic problems to include exponential algebraic calculations
47.3.20 Demonstrate knowledge of the classes, voltage ratings and/or polarity of electronic components
47.3.21 Build a simple DC circuit that employs a safety device (e.g., fuse, circuit breaker)
47.3.22 Troubleshoot DC circuits using electrical test/measurement equipment

**BIL:** Recommended – ISS
**AC:** Mathematics, Science
**RC:** **A+, NKC**

| **EDU:** | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |

**Competency 47.4: Demonstrate proficiency in working with AC circuits**
*Competency Builders:*
47.4.1 Analyze the properties of a steady-state AC signal
47.4.2 Analyze the properties of a transient AC signal
47.4.3 Demonstrate knowledge of the principles and operational characteristics of sinusoidal and non-sinusoidal wave forms
47.4.4 Demonstrate knowledge of AC sources
47.4.5 Demonstrate knowledge of the principles and operational characteristics of capacitive circuits
47.4.6 Operate capacitive circuits
47.4.7 Demonstrate knowledge of the principles and operational characteristics of inductive circuits
47.4.8 Operate inductive circuits
47.4.9 Demonstrate knowledge of the principles and operation of transformers
47.4.10 Operate AC circuits utilizing transformers
47.4.11 Analyze AC circuits using Thevenin's and Norton's theorems
47.4.12 Measure power in AC circuits

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| 47.4.13 | Troubleshoot AC circuits using capacitor and inductor analyzers |
| 47.4.14 | Determine RC and RL time constants using differentiators and integrators |
| 47.4.15 | Demonstrate knowledge of the principles and operational characteristics of series and parallel resonant circuits |
| 47.4.16 | Build series and parallel resonant circuits |
| 47.4.17 | Demonstrate knowledge of the classes, voltage, ratings, and/or polarity of electronic components |
| 47.4.18 | Build a simple AC circuit that employs a safety device (e.g., fuse, circuit breaker) |
| 47.4.19 | Demonstrate knowledge of the principles and operational characteristics of frequency selective filter circuits |
| 47.4.20 | Calculate gain (dB) using logarithmic tables or calculator/computer |
| 47.4.21 | Operate frequency selective filter circuits |
| 47.4.22 | Operate polyphase circuits |
| 47.4.23 | Demonstrate knowledge of basic motor theory and operation |
| 47.4.24 | Demonstrate knowledge of basic generator theory and operation |
| 47.4.25 | Operate power supplies for AC circuits |
| 47.4.26 | Demonstrate knowledge of the principles and operation of various power conditioning systems (e.g., isolation transformers, surge suppressors, uninterruptable power systems) |
| 47.4.27 | Demonstrate knowledge of the principles and operation of various safety grounding systems (e.g., lightning arresters, ground electrostatic discharge, fault interrupters) |
| 47.4.28 | Demonstrate knowledge of both the steady-state and transient behavior of inductors in series and parallel circuits |
| 47.4.29 | Demonstrate knowledge of both the steady-state and transient behavior of capacitance in series and parallel circuits |
| 47.4.30 | Compare resistive-capacitive (RC) and resistive-inductive (RL) time constants (TC) |
| 47.4.31 | Measure voltage, current, time, frequency (f), and phase relationships of AC sine wave signal |
| 47.4.32 | Demonstrate knowledge of the amplitude relationship to both frequency and phase for low- and high-pass circuits |
| 47.4.33 | Demonstrate knowledge of the resonance of inductive-capacitive (LC) circuits |
| 47.4.34 | Calculate impedance match and maximum transfer of power |
| 47.4.35 | Measure current, voltage, and resistance in AC circuits |
| 47.4.36 | Demonstrate knowledge of simple AC generator action |
| 47.4.37 | Demonstrate knowledge of simple AC motor action |
| 47.4.38 | Calculate power factor in AC circuits |
| 47.4.39 | Demonstrate knowledge of power factor correction in reactive loads |
| 47.4.40 | Demonstrate knowledge of the harmonics of sinusoidal voltage and current wave forms and their effects on power quality |
| 47.4.41 | Solve basic trigonometric problems |
| 47.4.42 | Calculate peak (PK), root mean square (RMS), and average values for sinusoidal wave forms |
| 47.4.43 | Troubleshoot AC circuits |

# Unit 48: Fundamentals of Electronics Technology

**BIL:** Recommended – ISS
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |

**Competency 48.1: Demonstrate proficiency in working with discrete solid-state devices**
*Competency Builders:*

48.1.1 Demonstrate knowledge of the properties of semiconductor materials
48.1.2 Demonstrate knowledge of the operating characteristics and applications of PN junctions
48.1.3 Demonstrate knowledge of the function and operation of diode circuits
48.1.4 Troubleshoot diode circuits
48.1.5 Repair diode circuits
48.1.6 Demonstrate knowledge of the operating characteristics and applications of bipolar transistors
48.1.7 Demonstrate knowledge of the operating characteristics and applications of field effect transistors (e.g., FET + s/MOSFET + s)
48.1.8 Demonstrate knowledge of the operating characteristics and applications of special diodes/transistors
48.1.9 Demonstrate knowledge of the operating characteristics and applications of opto-electronic devices (e.g., gate isolators, interrupt sensors, infrared sensors)
48.1.10 Demonstrate knowledge of the operating characteristics and applications of single-stage amplifiers
48.1.11 Demonstrate knowledge of the operation of single-stage amplifiers
48.1.12 Troubleshoot single-stage amplifiers
48.1.13 Repair single-stage amplifiers
48.1.14 Demonstrate knowledge of the function and operation of thyristor circuitry (SCR, TRIAC, DIAC)
48.1.15 Troubleshoot thyristor circuitry (SCR, TRIAC, DIAC)
48.1.16 Operate power supplies for solid-state devices
48.1.17 Operate oscilloscopes for solid-state devices
48.1.18 Operate function generators for solid-state devices
48.1.19 Operate curve tracers
48.1.20 Operate transistor testers

**BIL:** Essential – ISS Recommended – NS
**AC:** Mathematics
**RC:** NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | P |
| NS | | P | |

**Competency 48.2: Distinguish between analog and digital phenomena and circuits**
*Competency Builders:*

48.2.1 Demonstrate knowledge of the analog and digital measurement techniques for physical parameters (e.g., temperature, time, current, number of items coming down a production line)
48.2.2 Distinguish between an analog and a digital clock
48.2.3 Demonstrate knowledge of the function and operation of the instruments used to measure analog signals
48.2.4 Demonstrate knowledge of the function and operation of the instruments used to measure analog digital signals
48.2.5 Demonstrate knowledge of how an analog signal can be converted to a digital signal
48.2.6 Demonstrate knowledge of how a digital signal can be converted to an analog signal

**BIL:** Essential – ISS
**AC:** Science
**RC:** A+, CNA, CNE

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |

**Competency 48.3: Demonstrate proficiency in working with microcomputer systems**
*Competency Builders:*

48.3.1 Demonstrate knowledge of the essential components of microcomputers and the functions of each (ISS)
48.3.2 Demonstrate knowledge of the principles and operation of bus concepts (e.g., VESA, EISA) (ISS)
48.3.3 Demonstrate knowledge of the principles and operation of different types of memory circuits
48.3.4 Demonstrate knowledge of the operating systems (e.g., DOS, OS/2, UNIX) (ISS)
48.3.5 Demonstrate knowledge of the microprocessor instruction sets (ISS)
48.3.6 Demonstrate knowledge of the principles and operation of microprocessor machine code
48.3.7 Apply microprocessor machine code
48.3.8 Disassemble microprocessor machine code
48.3.9 Demonstrate knowledge of types of input and output devices and peripherals (ISS)
48.3.10 Demonstrate knowledge of the principles and operation of storage devices (ISS)

48.3.11 Connect input and output ports to peripherals (ISS)
48.3.12 Demonstrate knowledge of central processing unit building blocks and their uses (ISS)
48.3.13 Demonstrate knowledge of the levels of computer languages (ISS)

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** A+, CNE

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |

**Competency 48.4: Demonstrate proficiency in working with computer system architecture**

*Competency Builders:*

48.4.1 Demonstrate knowledge of the principles and operation of computer system architecture (ISS)
48.4.2 Operate computer system architecture
48.4.3 Repair computer system architecture
48.4.4 Demonstrate knowledge of the principles and operation of addresses and interrupts
48.4.5 Demonstrate knowledge of the principles and operation of volatile and nonvolatile memory
48.4.6 Demonstrate the use of volatile and nonvolatile memory
48.4.7 Repair/replace volatile and nonvolatile memory
48.4.8 Demonstrate knowledge of the principles and operation of advanced memory techniques
48.4.9 Define individual system blocks
48.4.10 Draw systems configuration in block detail
48.4.11 Interpret computer acronyms
48.4.12 Demonstrate knowledge of priorities and interrupts at systems level
48.4.13 Demonstrate knowledge of direct-memory-access data-handling system(s)
48.4.14 Define functions of advanced memory techniques (e.g., virtual, pipeline, cache)

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** A+, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | P | |

**Competency 48.5: Demonstrate knowledge of the basic elements of communication interfacing**

*Competency Builders:*

48.5.1 Demonstrate knowledge of common EIA, IEEE, and ITU-T (formerly CCITT) communication standards (e.g., EIA 232 and 485, IEEE 488) and their applications
48.5.2 Demonstrate knowledge of the function and operation of sync devices
48.5.3 Demonstrate knowledge of the function and operation of async devices
48.5.4 Demonstrate knowledge of types of networks (e.g., token ring, Ethernet) (ISS)
48.5.5 Demonstrate knowledge of networking levels or layers
48.5.6 Demonstrate knowledge of protocols (ISS)
48.5.7 Demonstrate knowledge of the function and operation of packet switching
48.5.8 Demonstrate knowledge of multi-user systems
48.5.9 Demonstrate knowledge of types of network analyzer devices (e.g., breakout box, sniffers)
48.5.10 Operate network analyzer devices

**BIL:** Essential – ISS Recommended – NS
**AC:**
**RC:** A+, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | P | PR |
| NS | | P | |

**Competency 48.6: Apply troubleshooting and repair techniques to a microcomputer system**

*Competency Builders:*

48.6.1 Demonstrate knowledge of the role of preventive maintenance
48.6.2 Differentiate between normal and abnormal operations
48.6.3 Demonstrate knowledge of standard troubleshooting procedures
48.6.4 Identify available troubleshooting aids and tools
48.6.5 Demonstrate knowledge of safety rules for troubleshooting and repair
48.6.6 Demonstrate knowledge of the techniques for identifying thermal failures
48.6.7 Identify logical actions to take for a specific troubleshooting situation
48.6.8 Secure needed information using diagnostic software
48.6.9 Secure needed information using manufacturer's manuals, schematics, and troubleshooting charts
48.6.10 Interpret prints

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| 48.6.11 | Isolate faults to systems boards |
| 48.6.12 | Isolate faults to memory circuits |
| 48.6.13 | Isolate faults to data storage devices |
| 48.6.14 | Isolate faults in power supplies |
| 48.6.15 | Troubleshoot I/O ports |
| 48.6.16 | Isolate faults in I/O interface circuitry |
| 48.6.17 | Repair faults |
| 48.6.18 | Maintain troubleshooting and repair records |

# Unit 49: Telecommunications

**BIL:** Essential – ISS, NS
**AC:** Science
**RC:** A+, CCNA, CCNA-Curr, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | P | |

**Competency 49.1: Demonstrate knowledge of transmission line applications**

*Competency Builders:*

49.1.1 Define power conversion
49.1.2 Demonstrate knowledge of the principles and operation of two-wire and four-wire transmission lines (ISS)
49.1.3 Demonstrate knowledge of the principles and operation of coaxial cable (ISS)
49.1.4 Demonstrate knowledge of the principles and operation of a microwave guide and wireless (ISS)
49.1.5 Demonstrate knowledge of the principles and operation of fiber optics, analog, and digital circuits (ISS)

**BIL:** Recommended – ISS, NS
**AC:** Mathematics, Science
**RC:** CCNA, CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| NS | | I | IR |

**Competency 49.2: Demonstrate proficiency in working with transmitters and receivers**

*Competency Builders:*

49.2.1 Demonstrate knowledge of Federal Communication Commission (FCC) rules and regulations and PUCO
49.2.2 Demonstrate knowledge of the principles and operation of RF amplifiers
49.2.3 Demonstrate knowledge of the principles and operation of modulation/demodulation (e.g., AM, FM, SSB, DSSC, pulse modulation)
49.2.4 Construct modulators/demodulators
49.2.5 Operate modulators/demodulators
49.2.6 Demonstrate knowledge of the principles and operation of microwave and satellite communication systems
49.2.7 Demonstrate knowledge of the principles and operation of repeater systems (e.g., trunk and fiber/scramble/data)

**BIL:** Recommended – ISS, NS
**AC:**
**RC:** CCNA, CCNA-Curr, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| NS | | I | IR |

**Competency 49.3: Demonstrate knowledge of various types of multiplexing systems**
*Competency Builders:*
49.3.1 Demonstrate knowledge of the principles and operation of analog multiplexing systems (e.g., CATV)
49.3.2 Demonstrate knowledge of the principles and operation of digital multiplexing systems (e.g., T-1, fiber)

**BIL:** Recommended – ISS
**AC:** Mathematics, Science
**RC:** CCNA, CCNA-Curr

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |

**Competency 49.4: Troubleshoot transmitters, receivers, and antennas**
*Competency Builders:*
49.4.1 Isolate system faults in CRT modulation/demodulation circuits
49.4.2 Isolate system faults in RF transmitters and receivers
49.4.3 Isolate system faults in RF modulation/demodulation circuits
49.4.4 Isolate system faults in antenna systems

**BIL:** Essential – ISS Recommended – NS
**AC:** Science
**RC:** A+, CCNA, CCNA-Curr, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | I | P | |

**Competency 49.5: Demonstrate proficiency in working with data communications**
*Competency Builders:*
49.5.1 Demonstrate knowledge of the principles and operation of data communications, signaling systems, codes, formats, and protocols (ISS)
49.5.2 Demonstrate knowledge of the principles and operation of parallel and serial ports (ISS)
49.5.3 Demonstrate knowledge of the principles and operation of synchronous and asynchronous signals

49.5.4 Demonstrate knowledge of the principles and operation of data modems (ISS)
49.5.5 Operate data modems
49.5.6 Demonstrate knowledge of the principles and operation of fax machines (ISS)
49.5.7 Demonstrate knowledge of the principles and operation of various types of networks (e.g., Ethernet, token ring) (ISS)
49.5.8 Operate various types of networks
49.5.9 Employ accepted techniques for cable termination (e.g., UTP, COAX, FIBER)

**BIL:** Essential – NS Recommended – ISS
**AC:** Mathematics, Science
**RC:** CCNA, CCNA-Curr, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |
| NS | | I | P |

**Competency 49.6: Troubleshoot data communications**

*Competency Builders:*

49.6.1 Isolate system faults in data modems (NS)
49.6.2 Isolate system faults in various types of networks (NS)
49.6.3 Isolate system faults in various types of cable (NS)
49.6.4 Isolate system faults in various types of carrier systems (NS)
49.6.5 Demonstrate knowledge of networking topologies (NS)
49.6.6 Determine hardware communication faults utilizing diagnostic tools (NS)
49.6.7 Identify network problems utilizing network management tools (e.g., hardware, software carriers) (NS)

**BIL:** Recommended – ISS, NS
**AC:** Science
**RC:** CCNA, CCNA-Curr, CNE

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |

**Competency 49.7: Demonstrate proficiency in working with fiber optic communications systems**

*Competency Builders:*

49.7.1 Employ accepted techniques for fiber splicing
49.7.2 Employ accepted techniques for fiber termination
49.7.3 Demonstrate knowledge of the basic characteristics of optics (e.g., reflection, total reflection, and refraction)
49.7.4 Demonstrate knowledge of the characteristics and components of fiber optic cables
49.7.5 Identify bandwidth and attenuation limitations for fiber optic systems

49.7.6 Demonstrate knowledge of the technique of wavelength multiplexing in fiber optic cables
49.7.7 Demonstrate knowledge of the characteristics of various types of light sources and light detectors used in fiber optic systems
49.7.8 Identify the components of fiber optic transmission systems and the function of each
49.7.9 Demonstrate knowledge of how data signals are transformed into light pulses
49.7.10 Operate a simple fiber optic data transmission system
49.7.11 Demonstrate knowledge of the characteristics of multi-mode and single-mode systems

**BIL:** Recommended – ISS
**AC:** Communications
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |

**Competency 49.8: Practice RF systems safety**
*Competency Builders:*
49.8.1 Comply with safety procedures for working with RF systems antennae and support structures (e.g., towers)
49.8.2 Comply with safety procedures for working with RF systems high voltage/power supply
49.8.3 Comply with safety procedures for working with RF generators
49.8.4 Comply with safety procedures for working in RF radiating environments

**BIL:** Recommended – ISS
**AC:** Mathematics, Science
**RC:**

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | | I |

**Competency 49.9: Demonstrate knowledge of antenna systems**
*Competency Builders:*
49.9.1 Demonstrate knowledge of the principles and operation of single-element antennae (e.g., 1/4 wave dipole, longwire, vertical)
49.9.2 Demonstrate knowledge of the principles and operation of multi-element antennae (e.g., point-to-point, broadcast)
49.9.3 Demonstrate knowledge of the principles and operation of impedance matching of antennae systems
49.9.4 Demonstrate knowledge of antennae system measurement

**BIL:** Essential – ISS Recommended – NS
**AC:** Mathematics, Science
**RC:** CCNA, CCNA-Curr, MCSE, CNE, NKC

| EDU: | 10 | 12 | AD |
|---|---|---|---|
| ISS | | I | P |
| NS | | I | P |

**Competency 49.10: Demonstrate knowledge of telecommunications networks**

*Competency Builders:*

49.10.1 Demonstrate knowledge of the role telecommunication networks play in the contemporary business environment (ISS)
49.10.2 Demonstrate knowledge of how voice, data, and video inputs are converted to electromagnetic signals (ISS)
49.10.3 Demonstrate knowledge of advanced telecommunication technologies, including frame relay and ATM (ISS)
49.10.4 Demonstrate knowledge of how to design telecommunication protocols
49.10.5 Demonstrate knowledge of the TCP/IP protocol and how each layer functions
49.10.6 Identify applications that should be addressed using the client-server model
49.10.7 Demonstrate knowledge of the X.25 protocol
49.10.8 Demonstrate knowledge of the characteristics and function of ISDN and ISDN signaling
49.10.9 Demonstrate knowledge of the characteristics and function of frame relay congestion control
49.10.10 Demonstrate knowledge of the characteristics and function of asynchronous transfer mode (ATM)
49.10.11 Demonstrate knowledge of legacy traffic over ATM
49.10.12 Demonstrate knowledge of how ATM traffic is managed
49.10.13 Demonstrate knowledge of ATM PNNI
49.10.14 Demonstrate knowledge of mobile communications technologies, including cellular and personal communication networks
49.10.15 Demonstrate knowledge of international telecommunications standards, models, trends
49.10.16 Demonstrate knowledge of error detection and correction systems
49.10.17 Demonstrate knowledge of the characteristics and function of data compression
49.10.18 Demonstrate knowledge of the characteristics and function of data concentration

# APPENDICES

## Summary of Academic Connections

## Certification Crosswalk Summary

# APPENDIX A

## SUMMARY OF ACADEMIC CONNECTIONS

The following competencies are derived from the Ohio Model Competency-Based Program in Language Arts, Mathematics, and Science. A panel of secondary and post-secondary mathematics, language arts, and science educators working in conjunction with information technology subject matter experts identified competencies in these models critical for entry-level information technology employees.

Numbers after a competency indicate that this is a critical academic competency and indicate the number of times this competency was linked to an Ohio Information Technology Profile Competency. All competencies identified with twenty or more linkages are highlighted to illustrate the particular importance of this competency to the study of information technology.

# OHIO MODEL COMPETENCY-BASED LANGUAGE ARTS PROGRAM (9-12)

## Subunit: Reading/Structure

**Competencies:**

RS1 Exhibit knowledge of language structure
RS2 Recognize that there may be more than one interpretation of reading selections
RS3 Recognize various literary devices
RS4 Recognize and discuss literary elements
RS5 Develop and use an increasingly sophisticated vocabulary gained through context **(4)**
RS6 Apply knowledge of language structure to reading
RS7 Explain why there may be more than one interpretation of reading selections
RS8 Recognize effect of literacy devices on meaning
RS9 Analyze author's use of literary elements
RS10 Recognize relationship of structure to meaning
RS11 Describe various interpretations and meaning levels in reading selections **(2)**
RS12 Characterize author's use of literary devices
RS13 Characterize use of literary techniques **(2)**
RS14 Critique a variety of literature with regard to plot, dialogue, theme, setting, and characterization **(4)**
RS15 Apply an expanding vocabulary gained through reading **(2)**
RS16 Explain various interpretations and meaning levels in reading selections **(2)**
RS17 Analyze use of literary techniques (e.g., extended metaphor, simile, personification, hyperbole, pun, alliteration) **(6)**
RS18 Understand use of literary devices (e.g., irony, satire, allegory, onomatopoeia) **(2)**
RS19 Analyze and synthesize pieces of literature with regard to plot, dialogue, theme, setting, and characterization **(6)**

## Subunit: Reading/Meaning Construction

**Competencies:**

RM1 Demonstrate ability to recognize appropriate pre-reading strategies **(3)**
RM2 Describe effectiveness of a reading selection **(1)**
RM3 Read to clarify personal thinking and knowledge **(3)**
RM4 Support interpretation of text by locating and citing specific information **(32)**
RM5 Develop personal response to a variety of literary works **(9)**
RM6 Recognize diverse literary interpretations **(10)**
RM7 Engage in self-selected reading activities **(7)**
RM8 Confirm and extend meaning in reading by researching new concepts and facts **(19)**
RM9 Self-monitor and apply corrective strategies when communication has been interrupted or lost **(14)**
RM10 Use features of literary genres to extend meaning **(5)**
RM11 Assess effectiveness of a selection read
RM12 Use reading as a possible problem-solving strategy to clarify personal thinking and knowledge **(11)**
RM13 Use knowledge of semantic elements (e.g., figurative language, denotation, connotation, dialect) to clarify meaning when reading **(3)**

RM14 Predict, recognize, interpret, and analyze themes based on familiarity with author's work (3)
RM15 Compare and contrast literary genres (4)
RM16 Assess validity and quality of selection read (47)
RM17 Clarify meaning when reading (3)
RM18 Compare personal reaction to critical assessment of a literary selection (4)
RM19 Assess validity of diverse literary interpretations
RM20 Use reference books to find, evaluate, and synthesize information (48)
RM21 Identify tone of a literary work (1)
RM22 Critique validity of diverse literary interpretations (5)
RM23 Integrate personal reaction to and critical assessment of a literary selection (4)

## Subunit: Reading/Application

### Competencies:

RA1 Select and read material for personal enjoyment and information
RA2 Read a variety of complete, unabridged works
RA3 Employ various reading strategies according to purpose (3)
RA4 Participate in selection of books, materials, and topics for literature study groups
RA5 Develop and apply knowledge of the interrelationship of concepts (1)
RA6 Read selections from a variety of styles and formats, recognizing that style and format influence meaning (3)
RA7 Extend value of reading, writing, speaking, viewing, and listening by pursuing, through reading, new concepts and interests developed as a result of these activities
RA8 Read extensively from a particular author's work and explain elements of author's style (2)

## Subunit: Reading/Multidisciplinary

### Competencies:

RM1 Connect themes and ideas across disciplines through literature (29)
RM2 Read to facilitate learning across curriculum
RM3 Read to develop awareness of human rights and freedom
RM4 Participate actively in a community of learners
RM5 Recognize and explain interaction between literature and various cultural domains (e.g., social technological, political, economic) (29)
RM6 Explore and analyze a variety of cultural elements, attitudes, beliefs, and value structures by men and women of many racial, ethnic, and cultural groups
RM7 Value thinking and language of others
RM8 Relate literature to historical period about which or in which it was written
RM9 Read to facilitate content learning (28)

## Subunit: Writing/Structure

### Competencies:

WS1 Develop and expand a repertoire of organizational strategies (e.g., narration, comparison/contrast, and description) through a practice and discussion (52)
WS2 Clarify word choice according to audience, topic, and purpose (10)
WS3 Locate and correct errors in usage, spelling, and mechanics using a variety of resources (12)
WS4 Recognize information gained from primary and secondary sources (37)

WS5 Develop writing which contains ordered, related, well-developed paragraphs with sentences of varied lengths and patterns **(15)**

WS6 Use information from a variety of sources to develop an integrated piece of writing **(58)**

WS7 Evaluate and revise writing to focus on such things as audience, tone, and purpose **(12)**

WS8 Recognize differences between documentation and reference list styles **(12)**

WS9 Develop extended pieces of writing which contain ordered, related, well-developed paragraphs with sentences of varied lengths and patterns **(21)**

WS10 Select from a repertoire of organization strategies a pattern appropriate to a topic **(16)**

WS11 Synthesize information from a variety of sources **(51)**

WS12 Refine word choice and tone according to audience, situation, and purpose **(17)**

WS13 Appropriately cite information gained from primary and secondary sources **(46)**

WS14 Use style manuals or software to prepare documentation and reference lists **(49)**

WS15 Develop effectively organized pieces of expository writing containing strong voice, clear thesis, and well-developed ideas **(18)**

WS16 Identify organization patterns appropriate to writing topic **(20)**

WS17 Respond to others' suggested revisions to a writing piece **(3)**

## Subunit: Writing/Meaning Construction

### Competencies:

WM1 Demonstrate knowledge of the recursive nature of the writing process by applying it appropriately to various topics, situations, and audiences **(1)**

WM2 Develop criteria for writing evaluation using scoring guides and peer/teacher assistance to clarify meaning

WM3 Respond to others' suggested revisions to a piece of writing **(8)**

WM4 Use word processing, graphics, and publishing aids to construct meaning in writing **(19)**

WM5 Engage in self-initiated writing activities **(2)**

WM6 Incorporate personal criteria with generally accepted standards for writing evaluation

WM7 Evaluate, analyze, and synthesize information for writing **(5)**

WM8 Evaluate own writing using personal and established scoring criteria **(1)**

WM9 Assess personal/peer revisions to a writing piece **(51)**

WM10 Recognize and refine personal writing styles **(2)**

## Subunit: Writing/Application

### Competencies:

WA1 Apply appropriate writing techniques suitable for varied writing tasks **(31)**

WA2 Use sentence-combining techniques to improve syntactic fluency and maturity

WA3 Write in response to prompted and self-selected topics in practical, persuasive, descriptive, narrative, and expository domains **(3)**

WA4 Develop personal voice in writing **(7)**

WA5 Consider audience and purpose for writing **(43)**

WA6 Develop criteria for selection and potential development of topic **(21)**

WA7 Write in a journal or learning log to clarify personal thinking and knowledge **(1)**

WA8 Apply an expanding vocabulary gained through writing

WA9 Make judicious use of reference sources (e.g., dictionary, thesaurus, on-lien data base, encyclopedia) **(21)**

WA10 Demonstrate, an appreciation for aesthetically pleasing language through word choice and style **(16)**

WA11 Apply revising and editing strategies needed for writing task **(29)**

WA12 Vary sentence lengths and patterns **(9)**
WA13 Refine personal voice in writing **(7)**
WA14 Vary styles and formats for intended purpose and audience **(14)**
WA15 Apply criteria for selection and development of topic **(8)**
WA16 Participate in peer review of writing in progress **(24)**
WA17 Use transitions between sentences, ideas, and paragraphs in writing **(26)**
WA18 Revise and edit papers extensively in preparation for presentation/publication **(8)**
WA19 Develop a variety of genres **(1)**
WA20 Focus writing and tone on such elements as audience, situation, and purpose **(23)**
WA21 Develop topic fully and appropriately **(21)**
WA22 Use writing process to clarify personal thinking and knowledge **(5)**
WA23 Apply appropriate recursive writing process as suggested by writing task and writer's process
WA24 Develop an extended piece of writing
WA25 Revise writing and tone to assure focus on such elements as audience, situation, and purpose **(28)**
WA26 Use writing process to write reflectively

## Subunit: Writing/Multidisciplinary

### Competencies:

WM1 Use writing process for learning across curriculum
WM2 Use writing process to demonstrate knowledge of need for human rights and freedom
WM3 Value and apply collaborative skills in writing process
WM4 Write in response to reading, speaking, viewing, and listening
WM5 Use multidisciplinary resources in writing projects
WM6 Use writing process to facilitate learning across curriculum
WM7 Recognize value of and engage in collaboration in writing process
WM8 Use communication processes to develop a published writing piece in collaboration with others
WM9 Record experiences and observations related to content learning **(6)**
WM10 Apply collaborative skills in writing process
WM11 Write collaboratively with peers
WM12 Use cross-disciplinary resources in writing projects

## Subunit: Listening/Visual Literacy/Structure

### Competencies:

LS1 Listen to and view a wide variety of genres **(2)**
LS2 Become aware of an author's style through listening and viewing a variety of works **(2)**
LS3 Recognize correct and appropriate grammar, diction, and syntax
LS4 Expand vocabulary through listening to and viewing varied media
LS5 Recognize beauty of language
LS6 Enhance recognition of an author's style through listening and viewing a variety of works
LS7 Recognize use and misuse of language in media
LS8 Refine knowledge of style through listening and viewing multiple works by the same author

LS9 Expand and refine grammar, diction, and syntax through listening
LS10 Compare authors' styles through viewing and listening to their works
LS11 Expand knowledge of complex grammar, diction, and syntax issues

## Subunit: Listening/Visual Literacy/Meaning Construction

### Competencies:

LM1 Develop critical thinking skills necessary to evaluate media and assess oral presentations **(15)**
LM2 Compare new oral texts to past experiences and knowledge in order to enhance comprehension **(5)**
LM3 Recognize how rhythmic patterns, silence, and cadences enhance quality of speech and literature **(2)**
LM4 Focus listening and viewing on themes and/or plots **(8)**
LM5 Gather information from listening and viewing experiences to enhance research **(30)**
LM6 Use critical thinking skills to evaluate media and oral presentations **(25)**
LM7 Use prior knowledge and experiences to facilitate comprehension of new oral texts **(16)**
LM8 Identify rhythmic and time patterns in speech and literature **(1)**
LM9 Identify and analyze themes and/or plots when listening and viewing **(2)**
LM10 Use information gathered from listening and viewing experiences to expand research **(5)**
LM11 Enhance use of critical thinking skills to evaluate media and oral presentations **(13)**
LM12 Consider prior knowledge and experiences when attempting to understand the meaning of new texts **(24)**
LM13 Appreciate rhythmic and time patterns of speech and literature
LM14 Select viewing and listening materials to support written text
LM15 Evaluate media and oral presentations analytically and critically **(15)**
LM16 Organize prior knowledge and experiences to comprehend new texts **(1)**
LM17 Organize and use viewing and listening materials to support written text **(2)**

## Subunit: Listening/Visual Literacy/Application

### Competencies:

LA1 Listen attentively during oral reading **(2)**
LA2 Use media as stimuli for learning and thinking
LA3 Develop knowledge of structure through art, music, and literature
LA4 Use electronic media to enhance and highlight language learning **(1)**
LA5 Listen and view for entertainment and enjoyment
LA6 Use technology and other media as means of expressing ideas **(3)**

## Subunit: Listening/Visual Literacy/Multidisciplinary

### Competencies:

LM1 Facilitate learning across curriculum through critical listening and viewing
LM2 Engage in individual, small-group, and whole-group listening and viewing activities
LM3 Develop language arts (e.g., viewing, listening) projects collaboratively
LM4 Investigate language and cultural differences through listening and viewing activities
LM5 Participate in a community of learners through productive listening **(1)**

## Subunit: Oral Communication/Structure

**Competencies:**

OS1 Refine oral communication skills **(12)**
OS2 Demonstrate knowledge of grammar, usage, and syntax when presenting **(3)**
OS3 Select topics and vocabulary suitable to audience **(14)**
OS4 Organize notes and ideas for speaking **(11)**
OS5 Use language imaginatively **(2)**
OS6 Modulate voice to meaning when interpreting literature orally **(8)**
OS7 Organize notes and ideas for formal, semiformal and informal presentations of information **(3)**
OS8 Refine speaking techniques for formal, semiformal, and informal settings **(5)**
OS9 Develop repertoire of organizational strategies for presenting information orally **(11)**
OS10 Expand vocabulary to fit topic **(1)**
OS11 Select topics suitable to audience, situation, and purpose **(6)**
OS12 Select appropriate strategies when organizing notes and ideas for speaking **(4)**

## Subunit: Oral Communications/Meaning Construction

**Competencies:**

OM1 Make connections between prior knowledge and new information for oral presentations **(13)**
OM2 Participate in informal speaking activities **(1)**
OM3 Use interviewing techniques to gather information **(20)**
OM4 Communicate orally to entertain and to inform **(5)**
OM5 Participate in group communication activities **(8)**
OM6 Take and organize notes when preparing speech/presentation **(17)**
OM7 Interpret texts orally to illustrate meaning
OM8 Respond to needs of various audiences **(25)**
OM9 Gather and assess information for speaking **(11)**
OM10 Communicate orally to inform and persuade **(21)**
OM11 Prepare and deliver formal speech/presentation **(1)**
OM12 Participate in a variety of oral interpretations
OM13 Assess needs of audience and adjust language and presentation according to their knowledge **(30)**
OM14 Analyze and synthesize information for speaking **(4)**
OM15 Describe effectiveness of literary selection
OM16 Describe topic or idea in order to clarify personal/audience thinking **(5)**
OM17 Analyze and synthesize information gathered from a variety of sources for speaking **(9)**
OM18 Describe validity and/or quality of a literary selection and justify selection
OM19 Interpret orally a variety of literature
OM20 Describe topic or idea to clarify meaning for others **(11)**

## Subunit: Oral Communication/Application

**Competencies:**

OA1 Become proficient at using interviewing techniques **(29)**
OA2 Give an oral interpretation for a specific audience
OA3 Develop and apply oral communication skills for cooperative/collaborative learning **(4)**
OA4 Use oral communication for a variety of purposes and audiences (e.g., negotiations, book reviews, rationales) **(9)**

OA5 Develop and apply decision-making strategies
OA6 Practice interviewing techniques **(14)**
OA7 Apply interviewing techniques to purposeful interviews **(29)**
OA8 Focus oral interpretation on a specific audience **(14)**

## Subunit: Oral Communications/Multidisciplinary

### Competencies:

OM1 Value thinking and language of others **(2)**
OM2 Develop oral projects collaboratively **(2)**
OM3 Be involved in individual, small-group, and whole-group language activities
OM4 Participate actively in a community of learners
OM5 Investigate language and cultural differences through oral language activities **(9)**

# OHIO MODEL COMPETENCY-BASED MATHEMATICS PROGRAM (9-12)

## Subunit: Numbers and Number Relations

**Competencies:**

NR1 Compare, order, and determine equivalence of real numbers (**44**)
NR2 Estimate answers, compute, and solve problems involving real numbers (**46**)
NR3 Compare and contrast real number system, rational number system, and whole number system (**29**)
NR4 Extend knowledge to complex number system and develop facility with its operation (**6**)

## Subunit: Measurement

**Competencies:**

M1 Estimate and use measurements (**37**)
M2 Understand need for measurement and probability that any measurement is accurate to some designated specification (**3**)
M3 Understand and apply measurements related to power and work (**31**)
M4 Understand and apply measurement concepts of distance-rate-time problems and acceleration problems (**6**)
M5 Use real experiments to investigate elasticity, heat, sound, electricity, magnetism, light, acceleration, velocity, energy, and gravity (**24**)
M6 Use real-world problem situations involving mass and weight
M7 Use real-world problem situations involving simple harmonic motion (**2**)
M8 Establish ratios with and without common units (**23**)
M9 Construct and interpret maps, tables, charts, and graphs as they relate to real-world mathematics (**13**)
M10 Understand and solve rate-change problems (**9**)
M11 Understand and solve right triangle relationships as they relate to measurement, specifically to Pythagorean theorem
M12 Graph and interpret ordered pairs
M13 Compute total sales from a variety of items (**1**)
M14 Comprehend and compute rates of growth or decay (**15**)
M15 Comprehend, compute, and interpret real problems involving annuities (**3**)
M16 Develop an ability to identify real problems and provide possible solutions (**7**)
M17 Express and apply different types of measurement scales (**12**)
M18 Identify area and volume (**3**)

## Subunit: Estimation and Mental Computation

**Competencies:**

E1 Use estimation to eliminate choices in multiple-choice tests
E2 Use estimation to determine reasonableness of problem situations in a wide variety of applications
E3 Estimate shape of graphs of various functions and algebraic expressions
E4 Use mental computation when computer and calculator are inappropriate

## Subunit: Data Analysis and Probability

**Competencies:**

| | |
|---|---|
| D1 | Organize data into tables, charts, and graphs **(27)** |
| D2 | Understand and apply measures of central tendency, variability, and correlation **(29)** |
| D3 | Use curve fitting to predict from data **(17)** |
| D4 | Use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty **(32)** |
| D5 | Use computer simulations and random number generators to estimate probabilities **(28)** |
| D6 | Test hypotheses using appropriate statistics **(29)** |
| D7 | Read, interpret, and use tables, charts, and graphs to identify patterns, note trends, draw conclusions, and make predictions **(51)** |
| D8 | Identify probabilities of events involving unbiased objects **(9)** |
| D9 | Use sampling and recognize its role in statistical claims **(16)** |
| D10 | Design a statistical experiment to study problem, conduct experiment, and interpret and communicate outcomes **(43)** |
| D11 | Describe normal curve in general terms and use its properties **(6)** |
| D12 | Create and interpret discrete probability distributions **(10)** |
| D13 | Understand concept of random variable **(27)** |
| D14 | Apply concept of random variable to generate and interpret probability distributions, including binomial, uniform, and chi square **(34)** |

## Subunit: Algebra

### Competencies:

| | |
|---|---|
| A1 | Describe problem situations by using and relating numerical, symbolic, and graphical representations **(14)** |
| A2 | Use language and notation of functions in symbolic and graphing settings **(11)** |
| A3 | Recognize and use equivalent zeros of a function, roots and the solution of an equation in terms of graphical and symbolic representations **(14)** |
| A4 | Describe and use logic of equivalence in working with equations, inequalities, and functions **(12)** |
| A5 | Develop graphical techniques of solution for problem situations involving functions **(6)** |
| A6 | Explore and describe characterizing features of functions **(9)** |
| A7 | Make arguments and proofs in algebraic settings **(1)** |
| A8 | Factor difference of two squares **(1)** |
| A9 | Identify slope, midpoint, and distance **(4)** |
| A10 | Explore and combine rational functions **(4)** |
| A11 | Explore factoring techniques **(1)** |
| A12 | Solve quadratic equations by factoring and formula **(1)** |
| A13 | Set up and solve linear equations **(11)** |
| A14 | Solve systems of linear equations with two variables **(4)** |
| A15 | Describe geometric situations and phenomena using variables, equations, and functions **(7)** |
| A16 | Describe measures of central tendency, mean, median, mode, and variance algebraically and graphically **(4)** |
| A17 | Represent inequalities on number line and in coordinate plane **(3)** |
| A18 | Use coordinate arguments in making geometric proofs **(1)** |
| A19 | Symbolize transformations of figures and graphs **(6)** |
| A20 | Explore geometric basis for functions of trigonometry **(5)** |
| A21 | Graph linear functions **(4)** |
| A22 | Develop and use vectors to represent direction and magnitude including operations **(6)** |
| A23 | Use polar and parametric equations to describe, graph, and solve problem situations **(1)** |

A24 Represent sequences and series as functions both algebraically and graphically **(1)**
A25 Explore recursive functions and procedures using spreadsheets, other computer utilities, and appropriate notions **(4)**
A26 Describe and solve algebraic situations with matrices **(3)**
A27 Describe and use inverse relationship between functions including exponential and logarithmic **(10)**
A28 Analyze and describe errors and error sources that can be made when using computers and calculators to solve problems **(3)**
A29 Decide whether problem situation is best solved using computer, calculator, paper and pencil, or mental arithmetic/estimation techniques **(7)**
A30 Explore relationships between complex numbers and vectors **(2)**
A31 Make arguments concerning limits, convergence and divergence in context involving sequences, series, and other types of functions **(5)**
A32 Represent transformations in plane with matrices **(1)**
A33 Contrast and compare algebra's of rational, real, and complex numbers with characteristics of a matrix algebra system **(3)**
A34 Construct polynomial approximations of a function over specified intervals of convergence
A35 Examine complex numbers as zeros of functions **(2)**
A36 Translate verbal statements into symbolic language **(2)**
A37 Simplify algebraic expressions
A38 Use laws and exponents (including scientific notation) **(1)**
A39 Expand and extend idea of vectors and linear algebra to higher dimensional situations **(2)**
A40 Use the idea of independent basis elements for a vector space and associated fundamental concepts of finite dimensional linear algebra **(6)**
A41 Develop and communicate arguments about limit situations **(1)**
A42 Use matrices to describe and apply transformations **(1)**
A43 Develop and use polar and parametric equations to represent problem situations **(7)**
A44 Explore proofs by mathematical induction **(2)**

## Subunit: Geometry

### Competencies:

G1 Create and interpret drawings of three-dimensional objects **(4)**
G2 Represent problem situations with geometric models and apply properties of figures **(6)**
G3 Apply Pythagorean theorem
G4 Demonstrate knowledge of angles and parallel and perpendicular lines **(8)**
G5 Explore inductive and deductive reasoning through applications to various subject areas **(12)**
G6 Translate between synthetic and coordinate representations **(1)**
G7 Identify congruent and similar figures using transformation with computer programs **(10)**
G8 Deduce properties of figures using transformations and coordinates **(9)**
G9 Use deductive reasoning **(5)**
G10 Explore compass and straightedge constructions in context of geometric theorems **(2)**
G11 Demonstrate knowledge of and ability to use proof **(4)**
G12 Use variety of proof techniques (e.g., synthetic, transformational, and coordinate) **(3)**
G13 Use variety of proof formats, including T-proof (i.e., two-column) and paragraph proof **(3)**
G14 Explore different proof strategies **(3)**
G15 Investigate different proofs of theorems **(3)**

G16 Develop knowledge of an axiomatic system **(3)**
G17 Apply transformations and coordinates in problem solving **(4)**
G18 Represent problem situations with geometric models and apply properties of figures **(3)**
G19 Deduce properties of figures using vectors **(5)**
G20 Analyze properties of Euclidean transformations and relate translations to vectors **(1)**
G21 Apply vectors in problem solving **(5)**
G22 Develop further knowledge of axiomatic systems by investigating and comparing various geometry's

## Subunit: Patterns, Relations, and Functions

### Competencies:

P1 Model real-world phenomena with polynomial and exponential functions **(2)**
P2 Explore relationship between zeros and intercepts of functions **(2)**
P3 Translate among tables, algebraic expressions, and graphs of functions
P4 Use graphing calculator or computer to generate graph of a function **(22)**
P5 Explore relationship between a linear function and its inverse **(28)**
P6 Describe and use characteristics of polynomial functions in problem-solving situations **(2)**
P7 Explore conic sections and graph using graphing calculator or computer **(2)**
P8 Apply trigonometric functions to problem situations involving triangles **(14)**
P9 Discover relationships between algebraic description, kind, and properties of conic **(7)**
P10 Explore periodic real-world phenomena using sine and cosine functions **(7)**
P11 Analyze effects of parameter changes on graphs **(2)**
P12 Use graphing calculator or computer to graph functions **(7)**
P13 Develop an knowledge of rational and transcendental functions **(2)**
P14 Understand connections between trigonometric and circular functions **(2)**
P15 Use circular functions to model periodic real-world functions **(3)**
P16 Solve trigonometric equations and verify trigonometric identities **(14)**
P17 Understand connections between trigonometric, exponential, and logarithmic functions and polar coordinates, complex numbers, and series **(23)**
P18 Model real-world phenomena with a variety of functions **(17)**
P19 Graph using polar coordinates **(11)**
P20 Explore graphs in three dimensions **(15)**
P21 Explore functions of several variables **(15)**
P22 Explore recursive functions using spreadsheets and/or programming languages **(5)**

# OHIO MODEL COMPETENCY-BASED SCIENCE PROGRAM (9-12)

## Subunit: Scientific Inquiry

### Competencies:

Q1 Check the appropriateness and accuracy of measures and computations using various strategies (e.g., estimations, unit analysis, determination of significant figures) **(3)**

Q2 Use ratios, proportions, and probabilities in appropriate problem situations **(1)**

Q3 Translate information from and represent information in various forms with equal ease (e.g., tables, charts, graphs, diagrams, geometric figures) **(7)**

Q4 Use existing algebraic formulas and create new ones in appropriate problem-solving situations **(4)**

Q5 Estimate and justify probabilities of outcomes of familiar situations based on experimentation and other strategies **(2)**

Q6 Invent apparatus and mechanical tools needed to perform unique tasks in various situations **(3)**

Q7 Identify, compare, and contrast different modes of inquiry, habits of mind, and attitudes and dispositions **(4)**

Q8 Design investigations that are safe and ethical (i.e., obtain consent and inform others of potential outcomes, risks and benefits, and show evidence of concern for human health and safety, concern for non-human species) **(2)**

Q9 Make and read scale drawings, maps, models, and other representations to aid planning and understanding

Q10 Seek elaboration and justification of data and ideas, and reflect on alternative interpretations of the information **(10)**

Q11 Utilize appropriate units for counts and measures

Q12 Create and use databases (electronic and other) to collect, organize, and verify data and observations **(2)**

Q13 Design and conduct investigations with multiple variables **(3)**

Q14 Communicate the results of investigations clearly in a variety of situations **(3)**

Q15 Examine relationships in nature, offer alternative explanations for the observations, and collect evidence that can be used to help judge among explanations **(7)**

Q16 Trace the development (e.g., history, controversy, and ramifications) of various theories, focusing on supporting evidence and modification with new evidence **(9)**

Q17 Select, invent, and use tools, including analog and digital instruments, to make and record direct measurements **(12)**

Q18 Observe and document events and characteristics of complex systems **(12)**

Q19 Explain the influence of perspective (e.g., spatial, temporal, and social) on observation and subsequent interpretations **(2)**

Q20 Create multiple representations of the same data using a variety of symbols, descriptive languages, mathematical concepts, and graphic techniques **(12)**

Q21 Generate testable hypotheses for observations of complex systems and interactions **(4)**

Q22 Document potentially hazardous conditions and associated risks in selected homes and public areas **(1)**

Q23 Participate in public debates, relying on documented and verified data to construct and represent a position on scientific issues

Q24 Construct and test models of physical, biological, social, and geological systems

Q25 Read, verify, debate, and, where necessary, refute research published in popular or technical journals of science (e.g., *Discover, Omns, Popular Mechanics*) **(4)**

Q26 Explore discrepant events and develop and test explanations of what was observed **(14)**

Q27 Conduct theory-based research using surveys, observational instruments, and other methods

Q28 Modify personal opinions, interpretations, explanations, and conclusions based on new information **(4)**

Q29 Analyze error and develop explanations in various domains **(3)**

Q30 Formulate taxonomic schemes based upon multivariate models that help to explain similarities and differences in form, distribution, behavior, survival, and origin of objects and organisms **(2)**

Q31 Demonstrate various logical connections between related concepts (e.g., entropy, conservation of energy) **(5)**

Q32 Account for discrepancies between theories and observations **(8)**

Q33 Analyze the changes within a system when inputs, outputs, and interactions are altered **(18)**

Q34 Create, standardize, and document procedures **(6)**

Q35 Determine the sources of significant disparities between the predicted and recorded results and change research procedures to minimize disparities **(4)**

Q36 Research, locate, and propose applications for abstract patterns (e.g., fractals, Fibonacci sequences, string theory, orbitals)

Q37 Recognize and utilize classification systems for particles, elements, compounds, phenomena, organisms, and others for exploring and predicting properties and behaviors

Q38 Suggest and defend alternative experimental designs and data explanations (e.g., sampling, controls, safeguards) **(5)**

Q39 Recognize and communicate differences between questions that can be investigated in a scientific way and those that rely on other ways of knowing

Q40 Draw conclusions based on the relationships among data analysis, experimental design, and possible models and theories **(2)**

Q41 Suggest new questions as a result of reflection on and discussions about their own scientific investigations **(1)**

Q42 Investigate, assess, and comment on strengths and weakness of the descriptive and predictive powers of science

Q43 Create new information from representations of data in a variety of forms (e.g., symbols, descriptive languages, graphic formats) utilizing a variety of techniques (e.g., interpolations, extrapolations, linear regressions, central tendencies, correlation) **(7)**

## Subunit: Scientific Knowledge

### Competencies:

K1 Investigate various types of dynamic equilibrium (e.g., biological, geological, mechanical, chemical) **(4)**

K2 Investigate the relationship between the rates of energy exchange and the relative energy level of components with systems (e.g., trophic levels of ecosytems, osmosis, rate of heating and cooling, storms) **(60)**

K3 Investigate patterns in the natural world (e.g., heredity, crystalline structures, population and resource distributions, diffraction, dispersion, polarization) **(2)**

K4 Investigate models and theories that help to explain the interactions of components in systems (e.g., conservation of mass, energy, and momentum; foodwebs; natural selection; entropy; plate tectonics; chaos; relativity; social-psychology)

K5 Investigate degrees of kinship among organisms and groups of organisms

K6 Investigate the limits of the definition of life, and investigate organisms and physical systems that exist at or near these limits (e.g., viruses, quarks, black holes)

K7 Investigate estimates and measurements of a wide range of distances and rates of change

K8 Investigate the historical development of theories of change over time (e.g., natural selection, continental drift, the big bang, geologic change)

K9 Investigate physical and chemical changes in living and non-living systems (e.g., photosynthesis, weathering processes, glaciation, thermal effects of materials, energy cells) **(1)**

K10 Investigate simulations of nuclear change (e.g., radioactivity, half life, carbon dating)

K11 Investigate conservation principles associated with physical, chemical, and nuclear changes **(1)**

K12 Formulate descriptions of the impacts of various forms of mechanical and electromagnetic waves on various organisms on each other over time **(67)**

K13 Formulate models and hypotheses for patterns in the natural world (e.g., earth structures, transportation systems, migrations, communications, constellations) **(1)**

K14 Formulate explanations for the influences of objects and organisms on each other over time

K15 Formulate and interpret explanations for change phenomena (e.g., mass extinctions, stellar evolution, punctuated equilibrium, molecular synthesis)

K16 Formulate and interpret explanations for the magnitudes of diversity at different periods of geologic time (e.g., mutation, global cataclysms, continental drift, competition, mass extinctions)

K17 Formulate interpretations of the structure, function, and diversity in a variety of organisms and physical systems (e.g., DNA and RNA variants, nucleons, interaction particles)

K18 Formulate understandings of geologic time (e.g., millennia, periods, epochs)

K19 Formulate an understanding of the historical development of the model of the universe

K20 Formulate explanations and representations of the production, transmission, and conservation of energy in biological and physical systems (e.g., weather, volcanism, earthquakes, electricity, magnetism, cellular respiration) **(58)**

K21 Formulate models and hypotheses about patterns in the natural world (e.g., social behavior, molecular structure, energy transformation, entropy, randomness, aging, chaos, hormonal cycles) **(2)**

K22 Formulate interpretations of the relationship between energy exchange and the interfaces between components within systems **(57)**

K23a Formulate estimations for the range of energies within and between various phenomena (e.g., thermal, electromagnetic, thermonuclear, chemical, electrical) **(52)**

K23b Formulate explanations for the historical development of descriptions of motions interactions and transformations of matter and energy (e.g., classical Newtonian mechanics, special and general relativity, chaos) **(1)**

K24 Formulate models that can be used to describe fundamental molecular interactions in living and non-living systems (e.g., cell membranes, semiconductors) **(1)**

K25 Formulate an understanding of the degree of relationship among organisms and objects based on molecular structure (e.g., proteins, nucleic acids)

K26 Formulate hypotheses and models that may account for observable events (e.g., electricity and magnetism, gravitation, atoms, bonding, chemical reactions, quantum effects, energy flow on biological systems, predator-prey relationships) **(68)**

K27 Formulate models and hypotheses about change over time (e.g., natural selection, speciation, punctuated equilibrium, phyleytic gradualism, stellar evolution, plate tectonics, radioactive decay, quantum mechanical theory)

K28 Formulate lists of limitations and propose refinements of standard classification systems (e.g., periodic table, IUPAC, Linnean, standard model)

K29 Formulate specific cases of limitations and possible exceptions of theories and principles regarding the interactions of moving objects and organisms (e.g., fluid flow in vessels, motion near the speed of light, Heisenberg uncertainty principle, meteorological prediction, local variation and diversity, predicting earthquakes, energy transport in cellular respiration)

K30 Formulate plans and contingencies that can be used to accommodate for changes to and stresses on systems (e.g., wildlife and habitat management, corrosion prevention, noise abatement, structure design) **(1)**

K31 Formulate models of molecular, atomic, ionic, and subatomic structures and the physical and biological implications of these structures (e.g., genes, nucleons, quarks) **(1)**

K32 Formulate estimates for a wide range of measurements and scales (e.g., angstroms to light years) **(1)**

K33 Formulate and interpret representations of time from origin to present accounting for phenomena of scale (e.g., smoothness, punctuations, chaos)

K34 Formulate interpretations of the historical development of various theories of possible causes of diversity among physical and biological phenomena (e.g., the works of Aristotle, Mendel, Darwin, McClintock) **(1)**

K35 Formulate models and hypotheses that can be used to explain the interactions of components within technological and ecological systems **(3)**

## Subunit: Conditions for Learning Science

### Competencies:

C1 Participate actively in dialogue about and resolution of community issues **(4)**

C2 Assess information from various countries in the original language or translated form to ascertain the perspectives of many cultures **(5)**

C3 Analyze the scientific ideas presented in science fiction stories and films

C4 Perform and repeat investigations to verify data, determine regularity, and reduce the impact of experimental error

C5 Present the results of investigations in a variety of forums

C6 Contribute to the decisions regarding topics for investigation

C7 Use various creative means to communicate interpretations of scientific ideas, concepts, phenomena, and events **(1)**

C8 Consider the scientific thinking and language of others **(1)**

C9 Individually and collaboratively produce clearly written representations of investigative results

C10 Fulfill responsibilities as part of a research group

C11 Select and utilize resources by various criteria (e.g., efficiency, effectiveness, health, safety) that are appropriate to the investigations being conducted by groups **(1)**

C12 Present persuasive argument based on the scientific aspects of controversial issues

C13 Collect, store, retrieve, and manipulate information with available technologies alleges that may range from hand processes up through computer applications **(5)**

C14 Investigate social issues with a scientific perspective (e.g., human rights, wellness, economics, futurism, environmental ethics)

C15 Keep journals of observations and inferences made over an extended period of time and reflecting upon the impact of these recorded ideas on their thinking and actions
C16 Examine the intellect, perspectives, and ethics of notable scientists **(2)**
C17 Collect and analyze observations made over extended periods of time and compare these to scientific theories **(4)**
C18 Create presentations of scientific understandings using diverse modes of expressions
C19 Conduct formal scientific debates in the classroom
C20 Wonder about the likelihood of events that may occur by chance or coincidence
C21 Plan and conduct field trips and experiences for small and large groups
C22 Analyze the historical context which leads to and has lead to scientific theories **(2)**
C23 Seek information on topics of personal scientific interest from a variety of sources **(2)**
C24 Conduct learner-developed investigations independently and collaboratively over periods of week and months
C25 Listen attentively and critically to presentations of scientific information made by others **(4)**
C26 Conduct analyses of propaganda related to scientific issues
C27 Perform investigations that require observations over varying periods of time **(2)**
C28 Experience scientific concepts as interpreted by other cultures through multimedia and local and global specialists
C29 Access appropriate technology to perform complicated, time-consuming tasks **(2)**
C30 Relate historical accounts of science to the cultural context in which they were written
C31 Work as a contributing member of a collaborative research group
C32 Examine the influences of social and political structures and realities that contribute to inquiry about scientific issues
C33 Use technology (e.g., desktop publishing, teleconferencing, networking) to communicate scientific ideas **(1)**
C34 Explore and analyze a variety of perspectives on science (e.g., works by men and women of many racial, ethnic, and cultural groups)
C35 Lead groups of learners of various ages in designing, planning, and conducting science activities **(4)**
C36 Respect the scientific thinking of others and self **(4)**
C37 Recognize and contrast different epistemologies **(4)**
C38 Develop possible courses of action in response to scientific issues of local and global concern
C39 Determine the validity of research conclusions in relation to the design, performance, and results
C40 Develop multimedia presentations of group and individual research projects and investigations appropriate for a variety of audiences and forums
C41 Produce interesting and scientifically correct stories and present them using various modes of expression
C42 Reflect on the ideas and content found in their own journal records **(2)**
C43 Examine ambiguous results and formulate explanations **(4)**
C44 Recognize and synthesize the contributions to scientific thought of individuals from many cultures **(1)**
C45 Construct models and simulations of the component structures and functions of living and non-living entities
C46 Lead multi-age groups in the examination of and planned resolution for scientific issues **(4)**

C47 Recognize and choose members of research teams based upon the merit of their ideas and skills
C48 Construct a portfolio of products, documentation, and self-evaluations of his/her own abilities, skills, and experiences
C49 Synthesize scientific information from a variety of sources **(5)**
C50 Evaluate and prioritize scientific issues based upon risk-benefit analyses **(4)**
C51 Refining scientific skills from a variety of experiences

## Subunit: Applications for Science Learning

### Competencies:

A1 Answer student-determined questions by designing databases and drawing inferences from the analyses of the information in these data bases **(1)**
A2 Make personal behavior decisions by interpreting information that has a scientific basis
A3 Propose courses of action that will validate and demonstrate personal understandings of scientific principles
A4 Guide other learners in their understanding of the interactions of technologies and society at various periods in time
A5 Promote and carry out practices that contribute to a sustainable environment
A6 Study and propose improvements in public services and systems in their community
A7 Choose consumer materials utilizing personal and environmental risk and benefit information
A8 Make inferences and draw conclusions using databases, spreadsheets, and other technologies **(1)**
A9 Do simple trouble-shooting on common electrical and mechanical systems, identifying and eliminating possible causes of malfunctions
A10 Construct devices that perform simple, repetitive actions
A11 Investigate the functionality of various geometric shapes in the natural world and the designed world (e.g., translations from spherical to plan representations cause distortions, triangular shapes contribute to rigidity and stability in structures, round shapes minimize boundary for a given capacity)
A12 Make decisions regarding personal and public health
A13 Evaluate the social and ecological risks and benefits resulting from the use of various consumer products **(3)**
A14 Analyze the contributions of advances in technology through history to his/her everyday life **(3)**
A15 Identify and reduce risks and threats to a sustainable environment
A16 Extend the limits of human capabilities using technological enhancements **(1)**
A17 Use and recognize various propaganda techniques
A18 Solve unique problems using the results of systematic analyses
A19 Choose everyday consumer products that utilize recent innovative and pass appropriate performance criteria
A20 Refine personal career interests through investigations of the diversity of manufacturing, research, service, and invention processes
A21 Predict and investigate the working of toys and tools while controlling and manipulating variables (e.g., friction, gravity, forces)
A22 Write, follow, modify, and extend instructions (e.g., equations, algorithms, formulas, flow diagrams, illustrations) **(4)**
A23 Create products, make inferences, and draw conclusions using databases, spreadsheets, and other technologies **(4)**

A24 Predict various scenarios and propose solutions to community issues using scientific information (e.g., actuarial tables, census data, topographic maps, incidence data, climatic data)

A25 Use scientific evidence to consider options and formulate positions about the health and safety of others and him/herself

A26 Search for, use, create, and store objects and information using various strategies and methods of organization and access

A27 Research and write environmental impact statements of his/her own design

A28 Compare school-based science perspectives with those gained through cutting-edge technological applications

A29 Design management plans for natural and human-altered environments (e.g., woodlots, patios, lots, lawns, farmlands, forests)

A30 Refine personal career interests (**3**)

A31 Promote public awareness of the interaction of technology with social issues

A32 Advocate and propose courses of action for local and global scientific issues using global networks

A33 Use appropriate technologies to prepare and present the findings of investigations incorporating tables, graphs, diagrams, and text (**6**)

A34 Make informed consumer choices by evaluating and prioritizing information, evidence, and strategies

A35 Develop an informed point-of-view that allows for validation or refutation of the scientific statements and claims of advocated before pursuing courses of action (e.g., contributing support, signing petitions, casting votes)

A36 Differentiate between observations and inferences in the exploration of evidence related to personal, scientific, and community issues

A37 Develop and write environmental impact and safety and hygiene management plans

A38 Use technology to collect, analyze, and communicate information (e.g., electronic networks, desktop publishing, remote sensing, graphing calculators, satellite telemetry, and others) (**6**)

A39 Design, construct, and market inventions

# APPENDIX B

# CERTIFICATION CROSSWALK SUMMARY

**AREA OF CERTIFICATION:**

A+ Certification (Core Examination and Dos/Windows)

**WHAT IS A+ CERTIFICATION?**

A+ Certification is a testing program, sponsored by the Computing Technology Industry Association (CompTIA), that certifies the competency of service technicians in the computer industry. Anyone who wants a nationally recognized credential as a competent computer service professional can take the A+ exams. Major computer hardware and software vendors, distributors, resellers and publications, as well as a leading industry service organization, the Association of Field Service Management, Inc., back this program. The test, which is administered by Sylvan Prometric (Bloomington, MN), was first available in July 1993, with a complete revision of the exam occurring July 31, 1998.

The Computing Technology Industry Association developed the A+ program as a means of identifying cross-industry microcomputer repair skills to ensure a high quality labor force to implement warranty repair programs. Before this program was implemented, microcomputer repair technicians were required to obtain a separate certification for each manufacturer's product. A service technician might have been required to prove competency on up to fifty different products. This was an expensive and time consuming proposition for all service providers, including small local businesses, international system integrators, and all sized organizations in between.

Earning A+ certification means that you possess the knowledge, skills, and customer relations skills essential for a successful computer service technician, as defined by experts from companies across the industry. The exams cover a broad range of hardware and software technologies, but are not related to any vendor-specific products.

To become certified, you must pass two test parts—the Core and the Operating System module. When both the Core and the Operating System portion are passed, the candidate received the A+ designation.

## A+ CERTIFICATION CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in A+ Certification.

**PLEASE NOTE:**

X = competency is addressed  O = competency is partially addressed

| Unit | A+ |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.4 Demonstrate knowledge of the classes of software associated with information systems | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| 3.2 Access information using electronic sources | X |
| 3.3 Demonstrate proficiency with electronic mail | X |
| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | X |
| 6.3 Provide support and training | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | X |
| 18.2 Analyze the computer site environment | X |
| 18.3 Demonstrate knowledge of computer architecture and processor types | X |
| 18.4 Demonstrate basic knowledge of computer system architecture | X |
| 18.5 Demonstrate knowledge of CPU components | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.7 Explain operation of microprocessor systems | X |
| 18.8 Demonstrate knowledge of peripheral equipment | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | X |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | O |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | O |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | O |
| 19.8 Provide support and training | O |
| 19.9 Employ computer system interfaces | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | O |

| | |
|---|---|
| 20.5 Demonstrate knowledge of network connectivity basics | X |
| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| 20.8 Demonstrate knowledge of communication standards for networks | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.7 Troubleshoot problems | X |
| 33.8 Evaluate problem-solving processes and outcomes | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 36: Communication** | |
| 36.1 Apply communication skills | X |
| 36.3 Demonstrate sensitivity in communicating with a diverse workforce | X |
| **Unit 38: Customer Relations** | |
| 38.1 Build customer relations | X |
| **Unit 42: Management and Supervision** | |
| 42.1 Maintain a safe working environment | X |
| **Unit 47: Basic Electricity** | |
| 47.1 Demonstrate an understanding of electrical fundamentals | O |
| 47.2 Demonstrate knowledge of operating the various types of equipment used to test/measure DC circuits, AC circuits, solid-state devices, digital circuits, analog circuits, and microprocessors | O |
| 47.4 Demonstrate proficiency in working with AC circuits | O |
| **Unit 48: Fundamentals of Electronics Technology** | |
| 48.3 Demonstrate proficiency in working with microcomputer systems | O |
| 48.4 Demonstrate proficiency in working with computer system architecture | O |
| 48.5 Demonstrate knowledge of the basic elements of communication interfacing | O |
| 48.6 Apply troubleshooting and repair techniques to a microcomputer system | X |
| **Unit 49: Telecommunications** | |
| 49.1 Demonstrate knowledge of transmission line applications | X |
| 49.5 Demonstrate proficiency in working with data communications | O |

**AREA OF CERTIFICATION:**

Cisco Certified Network Associate (CCNA)

**WHAT IS CISCO CERTIFIED NETWORK ASSOCIATE?**

Cisco Certified Network Associate is one of several certifications offered as part of the Cisco Network Support Certification Track. This track is designed for professionals working with traditional Cisco-based networks that predominantly include LAN and WAN routers and LAN switches. CCNA focuses on relatively simple networks, while the forthcoming Certified Network Professional (CCNP) certificate focuses on the installation, configuration, operation, troubleshooting of more complex Cisco-based networks encompassing LAN/WAN routing, and LAN switching.

## CISCO CCNA CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in CCNA Certification.

**PLEASE NOTE:**

X = competency is addressed  O = competency is partially addressed

| Unit | CCNA |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.2 Demonstrate knowledge of the impact of information technology on society | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.5 Identify career opportunities in information systems | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| **Unit 5: Applied Programming Languages** | |
| 5.1 Apply computational and logical operations | X |
| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | O |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |

| | |
|---|---|
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.9 Design computer systems | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | O |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.2 Demonstrate knowledge of computer memory | O |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | O |
| 19.6 Maintain system | O |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.5 Demonstrate knowledge of network connectivity basics | X |
| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| 20.8 Demonstrate knowledge of communication standards for networks | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| **Unit 23: Wide-Area Networks** | |
| 23.1 Demonstrate knowledge of basic telecommunications and the interconnection of networks | X |
| 23.2 Assess user needs for a wide-area network (WAN) | X |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | O |
| 24.4 Perform network analysis, selection, and design | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| **Unit 30: Information Systems (IS) Theory** | |
| 30.1 Demonstrate a basic knowledge of systems theory and quality concepts | X |

| | |
|---|---|
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.7 Troubleshoot problems | X |
| 33.8 Evaluate problem-solving processes and outcomes | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 49: Telecommunications** | |
| 49.1 Demonstrate knowledge of transmission line applications | X |
| 49.2 Demonstrate proficiency in working with transmitters and receivers | X |
| 49.3 Demonstrate knowledge of various types of multiplexing systems | X |
| 49.4 Troubleshoot transmitters, receivers, and antennas | X |
| 49.5 Demonstrate proficiency in working with data communications | X |
| 49.6 Troubleshoot data communications | X |
| 49.7 Demonstrate proficiency in working with fiber optic communications systems | X |

**AREA OF CERTIFICATION:**

Cisco Certified Network Associate – Compared Curriculum (CCNA-Curr)

**WHAT IS CISCO CERTIFIED NETWORK ASSOCIATE – COMPARED CURRICULUM?**

The Cisco Certified Network Associate – Compared Curriculum was developed to train students and instructors on topics pertaining to the Cisco Certified Networking Associate (CCNA) exam. Concepts covered in this curriculum include networking, network terminology and protocols, network standards, LANs, WANs, the layers of the OSI reference model, cabling, cabling tools, routers, router programming, topologies, IP addressing, and network standards. Particular emphasis is given to the use of techniques in the maintenance and use of networking software, tools, and equipment. Projects and case studies, performance labs and skill tests are interwoven into this four-semester course. Skill tests and on-line mastery tests are given at the end of each semester. Students must pass all semesters before continuing the course.

## CISCO CERTIFIED NETWORK ASSOCIATE – COMPARED CURRICULUM CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in CCNA-Curriculum.

**PLEASE NOTE:**

X = competency is addressed  O = competency is partially addressed

| Unit | CCNA-Curr |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.2 Demonstrate knowledge of the impact of information technology on society | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.5 Identify career opportunities in information systems | X |
| 1.6 Explore the future of information technologies | X |
| **Unit 2: Computer Applications** | |
| 2.1 Create documents using word processing software | X |
| 2.5 Create presentations using presentation graphics software | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| 3.2 Access information using electronic sources | X |
| **Unit 5: Applied Programming Languages** | |
| 5.1 Apply computational and logical operations | X |

| | |
|---|---|
| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | X |
| 6.3 Provide support and training | O |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 16: Web Page Design** | |
| 16.1 Demonstrate knowledge of web page basics | O |
| 16.2 Demonstrate knowledge of Internet programming basics | X |
| 16.3 Apply knowledge of basic web programming | O |
| 16.4 Apply knowledge of web hosting | X |
| 16.8 Link documents | O |
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | O |
| 18.2 Analyze the computer site environment | X |
| 18.3 Demonstrate knowledge of computer architecture and processor types | X |
| 18.4 Demonstrate basic knowledge of computer system architecture | X |
| 18.5 Demonstrate knowledge of CPU components | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.7 Explain operation of microprocessor systems | X |
| 18.9 Design computer systems | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | O |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | O |
| 19.2 Demonstrate knowledge of computer memory | O |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.5 Demonstrate knowledge of network connectivity basics | X |
| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| 20.8 Demonstrate knowledge of communication standards for networks | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |

| | |
|---|---|
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| **Unit 23: Wide-Area Networks** | |
| 23.1 Demonstrate knowledge of basic telecommunications and the interconnection of networks | X |
| 23.2 Assess user needs for a wide-area network (WAN) | X |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.4 Perform network analysis, selection, and design | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| **Unit 30: Information Systems (IS) Theory** | |
| 30.1 Demonstrate a basic knowledge of systems theory and quality concepts | X |
| 30.2 Identify system infrastructure | X |
| 30.4 Compare/contrast individual and collaborative knowledge work | X |
| 30.5 Plan strategies for implementing system | X |
| 30.6 Facilitate measures of achievement | X |
| **Unit 31: Information Systems Management** | |
| 31.1 Conduct organizational planning for information systems | X |
| 31.2 Establish how information systems will be developed and managed within the organization | X |
| **Unit 32: Information System Analysis and Design** | |
| 32.2 Initiate a system project | X |
| 32.3 Perform a detailed system investigation and analysis | X |
| 32.4 Design an information system | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.7 Troubleshoot problems | X |
| 33.8 Evaluate problem-solving processes and outcomes | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 35: Project Management** | |
| 35.3 Develop time and activity plan to achieve objectives | X |
| 35.4 Manage work processes and procedures | X |

| | |
|---|---|
| **Unit 36: Communication** | |
| 36.1 Apply communication skills | X |
| 36.2 Compose documents | X |
| 36.3 Demonstrate sensitivity in communicating with a diverse workforce | X |
| 36.4 Deliver oral presentations | X |
| 36.5 Build interpersonal skills with individuals and other team members | X |
| **Unit 37: Technical Writing and Documentation** | |
| 37.1 Evaluate technical writing requirements | X |
| 37.2 Write technical reports | X |
| 37.3 Conduct technical research | X |
| 37.4 Design technical documentation | X |
| 37.5 Develop technical documentation | X |
| **Unit 38: Customer Relations** | |
| 38.1 Build customer relations | X |
| 38.2 Perform scheduling functions to meet customers needs | X |
| **Unit 42: Management and Supervision** | |
| 42.1 Maintain a safe working environment | X |
| **Unit 43: Business Law, Ethics and Legal Issues** | |
| 43.5 Demonstrate knowledge of social, ethical, and legal issues in the information technology field | X |
| **Unit 44: Quality Assurance** | |
| 44.3 Apply knowledge of quality cost implications | X |
| 44.4 Produce a quality product | X |
| **Unit 49: Telecommunications** | |
| 49.1 Demonstrate knowledge of transmission line applications | X |
| 49.2 Demonstrate proficiency in working with transmitters and receivers | X |
| 49.3 Demonstrate knowledge of various types of multiplexing systems | X |
| 49.4 Troubleshoot transmitters, receivers, and antennas | X |
| 49.5 Demonstrate proficiency in working with data communications | X |
| 49.6 Troubleshoot data communications | X |
| 49.7 Demonstrate proficiency in working with fiber optic communications systems | X |

**AREA OF CERTIFICATION:**

Microsoft Office User Specialist (MOUS)

**WHAT IS MICROSOFT OFFICE USER SPECIALIST?**

The Microsoft Office® User Specialist program provides a benchmark to validate users' skills in using Microsoft Office. The Specialist Program is available for many Microsoft Office 95 and Microsoft Office 97 applications at both Proficient and Expert User levels. Becoming a Microsoft Office User Specialist at the Proficient level indicates that you have a comprehensive understanding of the core features in a specific Microsoft Office 97 application. Pass any one of the Proficient exams: Microsoft Word 97 Proficient, Microsoft Excel 97 Proficient. The Specialist exam is not a written test. Instead, it features real-world assignments that are based on the way you actually use your computer.

## MICROSOFT OFFICE USER SPECIALIST CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in MOUS Certification.

**PLEASE NOTE:**

X = competency is addressed  O = competency is partially addressed

| Unit | MOUS |
|---|---|
| **Unit 2: Computer Applications** | |
| 2.1 Create documents using word processing software | X |
| 2.2 Create relational databases | X |
| 2.3 Create spreadsheets | X |
| 2.4 Perform desktop publishing functions | X |
| 2.5 Create presentations using presentation graphics software | X |
| 2.6 Integrate computer applications | X |
| **Unit 3: Data Communications** | |
| 3.2 Access information using electronic sources | O |
| 3.3 Demonstrate proficiency with electronic mail | X |
| **Unit 4: Programming Theory** | |
| 4.1 Demonstrate knowledge of programming language concepts | X |
| 4.2 Apply the process of algorithm and structured code development | X |
| 4.3 Demonstrate knowledge of the stages of program development | X |
| **Unit 5: Applied Programming Languages** | |
| 5.1 Apply computational and logical operations | X |
| 5.3 Apply language specific programming techniques | X |
| 5.4 Debug programs | X |
| **Unit 7: Software Development** | |
| 7.4 Code programs | X |

| | |
|---|---|
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| **Unit 10: Graphic Design Fundamentals** | |
| 10.4 Demonstrate knowledge of available graphics software programs | X |
| 10.5 Create computer graphics | X |
| 10.6 Apply knowledge of typography | X |
| **Unit 12: Digital Media Design** | |
| 12.4 Manipulate images | X |
| **Unit 16: Web Page Design** | |
| 16.2 Demonstrate knowledge of Internet programming basics | X |
| 16.5 Create/maintain a basic Internet programming document | X |
| 16.6 Format page layout | X |
| 16.8 Link documents | X |
| **Unit 26: Database Management System Basics** | |
| 26.1 Demonstrate knowledge of Database Management System (DBMS) basics | X |
| 26.2 Employ computational and logical operators | X |
| 26.3 Develop report-preparation programs | X |
| 26.4 Develop database programs | X |
| 26.5 Employ a DBMS | X |
| **Unit 27: Database Administration** | |
| 27.1 Apply databases to actual situations and business problems | X |
| **Unit 28: Data Warehousing** | |
| 28.4 Perform data retrieval | X |
| 28.5 Apply data | X |
| **Unit 34: System Administration and Control** | |
| 34.2 Apply data structure concepts to the storage and retrieval of data | X |
| 34.3 Query a database | X |
| 34.4 Create menus and display screens using system utilities | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |
| **Unit 38: Customer Relations** | |
| 38.2 Perform scheduling functions to meet customers needs | X |
| **Unit 46: Statistics** | |
| 46.3 Present data graphically | X |

**AREA OF CERTIFICATION:**

Microsoft Certified Professional (MCP)

**WHAT IS MICROSOFT CERTIFIED PROFESSIONAL?**

For those who want to demonstrate expertise with a particular Microsoft product, the Microsoft Certified Professional credential is offered. Candidates may pass additional Microsoft certification exams to further qualify their skills with Microsoft BackOffice Products, development tools, or desktop applications.

## MICROSOFT CERTIFIED PROFESSIONAL CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in MCP Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | MCP |
|---|---|
| **Unit 3: Data Communications** | |
| 3.3 Demonstrate proficiency with electronic mail | X |
| **Unit 4: Programming Theory** | |
| 4.1 Demonstrate knowledge of programming language concepts | X |
| 4.2 Apply the process of algorithm and structured code development | X |
| 4.3 Demonstrate knowledge of the stages of program development | X |
| **Unit 5: Applied Programming Languages** | |
| 5.1 Apply computational and logical operations | X |
| 5.2 Apply techniques for building applications | X |
| 5.3 Apply language specific programming techniques | X |
| 5.4 Debug programs | X |
| **Unit 7: Software Development** | |
| 7.1 Demonstrate knowledge of software development methodology | X |
| 7.4 Code programs | X |
| 7.9 Demonstrate knowledge of data structures | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| **Unit 15: Internet** | |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 16: Web Page Design** | |
| 16.1 Demonstrate knowledge of web page basics | X |
| 16.2 Demonstrate knowledge of Internet programming basics | X |

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| 16.3 Apply knowledge of basic web programming | X |
| 16.4 Apply knowledge of web hosting | X |
| 16.6 Format page layout | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | X |
| 19.9 Employ computer system interfaces | X |
| **Unit 21: Network Architectures** | |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| 22.3 Install network system | X |
| **Unit 23: Wide-Area Networks** | |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| 24.12 Explain disaster recovery and business continuance | X |
| **Unit 26: Database Management System Basics** | |
| 26.1 Demonstrate knowledge of Database Management System (DBMS) basics | X |
| 26.2 Employ computational and logical operators | X |
| 26.3 Develop report-preparation programs | X |
| 26.4 Develop database programs | X |
| 26.5 Employ a DBMS | X |
| 26.6 Manage implementation of a DBMS | X |
| 26.7 Monitor a DBMS | X |
| **Unit 27: Database Administration** | |
| 27.1 Apply databases to actual situations and business problems | X |
| 27.2 Apply data modeling techniques | X |
| 27.12 Identify backup and recovery requirements for physical models | X |
| 27.14 Identify physical database characteristics | X |

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| **Unit 28: Data Warehousing** | |
| 28.1 Demonstrate knowledge of basic data warehousing concepts | X |
| 28.3 Perform data entry and updating | X |
| 28.4 Perform data retrieval | X |
| 28.5 Apply data | X |
| **Unit 29: Application Development Life Cycle** | |
| 29.3 Develop computer programs in accordance with programming theory | X |
| 29.4 Test programs | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.6 Manage backup and recovery, both on- and off-site | X |
| 33.7 Troubleshoot problems | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 34: System Administration and Control** | |
| 34.2 Apply data structure concepts to the storage and retrieval of data | X |
| 34.3 Query a database | X |
| 34.4 Create menus and display screens using system utilities | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |

**AREA OF CERTIFICATION:**

Microsoft Certified Systems Engineer (MCSE)

**WHAT IS MICROSOFT CERTIFIED SYSTEMS ENGINEER?**

For network professionals, Microsoft offers the Microsoft Certified Systems Engineer credentials. MCSEs are qualified to effectively plan, implement, maintain, and support information systems in a wide range of computing environments using the Microsoft Windows NT® Server and the Microsoft BackOffice® integrated family of server products.

## MICROSOFT CERTIFIED SYSTEMS ENGINEER CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in MCSE Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | MCSE |
|---|---|
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| **Unit 15: Internet** | |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 16: Web Page Design** | |
| 16.4 Apply knowledge of web hosting | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | X |
| 19.9 Employ computer system interfaces | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.5 Demonstrate knowledge of network connectivity basics | X |

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| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| 22.3 Install network system | X |
| **Unit 23: Wide-Area Networks** | |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| 24.12 Explain disaster recovery and business continuance | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.6 Manage backup and recovery, both on- and off-site | X |
| 33.7 Troubleshoot problems | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 48: Fundamentals of Electronics Technology** | |
| 48.5 Demonstrate knowledge of the basic elements of communication interfacing | X |
| **Unit 49: Telecommunications** | |
| 49.5 Demonstrate proficiency in working with data communications | X |
| 49.6 Troubleshoot data communications | X |

**AREA OF CERTIFICATION:**

Microsoft Certified Solutions Developer (MCSD)

**WHAT IS MICROSOFT CERTIFIED SOLUTIONS DEVELOPER?**

The Microsoft Certified Solution Developer (MCSD) credential is a certification for professionals who design and develop custom business solutions with Microsoft development tools, technologies, and platforms. The track includes certification exams that test users' ability to build Web-based, distributed, and commerce applications by using Microsoft's products, such as Micrsoft SQL™ Server, Microsoft Visual Studio, and Microsoft Component Services. MCSDs are required to pass three core exams and one elective exam. The core technology exams require candidates to prove their competency with solution architecture, desktop applications development, and distributed applications development. The elective exam requires proof of expertise with Microsoft development tools. These exams are developed with the input of professionals in the industry and reflect how Microsoft products are used in organizations throughout the world. The exams are adminstered by Sylvan Prometric and Virtual University Enterprises, independent testing organizations with locations worldwide.

## MICROSOFT CERTIFIED SOLUTIONS DEVELOPER CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in MCSD Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | MCSD |
|---|---|
| **Unit 4: Programming Theory** | |
| 4.1 Demonstrate knowledge of programming language concepts | X |
| 4.2 Apply the process of algorithm and structured code development | X |
| 4.3 Demonstrate knowledge of the stages of program development | X |
| **Unit 5: Applied Programming Languages** | |
| 5.1 Apply computational and logical operations | X |
| 5.2 Apply techniques for building applications | X |
| 5.3 Apply language specific programming techniques | X |
| 5.4 Debug programs | X |
| **Unit 7: Software Development** | |
| 7.1 Demonstrate knowledge of software development methodology | X |
| 7.4 Code programs | X |
| 7.9 Demonstrate knowledge of data structures | X |

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| **Unit 16: Web Page Design** | |
| 16.2 Demonstrate knowledge of Internet programming basics | X |
| 16.3 Apply knowledge of basic web programming | X |
| 16.6 Format page layout | X |
| **Unit 19: Operating Systems** | |
| 19.2 Demonstrate knowledge of computer memory | X |
| **Unit 25: Basic Mainframe Concepts** | |
| 25.2 Design multi-tiered applications | X |
| **Unit 26: Database Management System Basics** | |
| 26.1 Demonstrate knowledge of Database Management System (DBMS) basics | X |
| 26.2 Employ computational and logical operators | X |
| 26.3 Develop report-preparation programs | X |
| 26.4 Develop database programs | X |
| 26.5 Employ a DBMS | X |
| 26.6 Manage implementation of a DBMS | X |
| **Unit 27: Database Administration** | |
| 27.1 Apply databases to actual situations and business problems | X |
| **Unit 28: Data Warehousing** | |
| 28.4 Perform data retrieval | X |
| 28.5 Apply data | X |
| **Unit 29: Application Development Life Cycle** | |
| 29.3 Develop computer programs in accordance with programming theory | X |
| 29.4 Test programs | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| **Unit 34: System Administration and Control** | |
| 34.2 Apply data structure concepts to the storage and retrieval of data | X |
| 34.3 Query a database | X |
| 34.4 Create menus and display screens using system utilities | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |

**AREA OF CERTIFICATION:**

Microsoft Certified DataBase Administrator (MCDBA)

**WHAT IS MICROSOFT CERTIFIED DATABASE ADMINISTRATOR?**

The Microsoft Certified Database Adminstrator credential is the premier certification for professionals who implement and administer Microsoft SQL Server™ databases. The certification is appropriate for individuals who derive physical database designs, develop logical data models, create physical databases, create data services by using Transact-SQL, manage and maintain databases, configure and manage security, monitor and optimize databases, and install and configure Microsoft SQL Server.

## MICROSOFT CERTIFIED DATABASE ADMINISTRATOR CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in MCDBA Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | MCDBA |
|---|---|
| **Unit 7: Software Development** | |
| 7.1 Demonstrate knowledge of software development methodology | X |
| 7.4 Code programs | X |
| 7.9 Demonstrate knowledge of data structures | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| **Unit 15: Internet** | |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| **Unit 16: Web Page Design** | |
| 16.4 Apply knowledge of web hosting | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | X |
| 19.9 Employ computer system interfaces | X |
| **Unit 21: Network Architectures** | |
| 21.7 Install basic system architectures using current Windows operating system software | X |

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| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| 22.3 Install network system | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| 24.12 Explain disaster recovery and business continuance | X |
| **Unit 25: Basic Mainframe Concepts** | |
| 25.2 Design multi-tiered applications | X |
| **Unit 26: Database Management System Basics** | |
| 26.1 Demonstrate knowledge of Database Management System (DBMS) basics | X |
| 26.2 Employ computational and logical operators | X |
| 26.3 Develop report-preparation programs | X |
| 26.5 Employ a DBMS | X |
| 26.6 Manage implementation of a DBMS | X |
| 26.7 Monitor a DBMS | X |
| **Unit 27: Database Administration** | |
| 27.1 Apply databases to actual situations and business problems | X |
| 27.2 Apply data modeling techniques | X |
| 27.3 Create conceptual data models | X |
| 27.4 Validate conceptual data models | X |
| 27.7 Create logical data models | X |
| 27.9 Normalize data models | X |
| 27.12 Identify backup and recovery requirements for physical models | X |
| 27.14 Identify physical database characteristics | X |
| **Unit 28: Data Warehousing** | |
| 28.1 Demonstrate knowledge of basic data warehousing concepts | X |
| 28.3 Perform data entry and updating | X |
| 28.4 Perform data retrieval | X |
| 28.5 Apply data | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.6 Manage backup and recovery, both on- and off-site | X |
| 33.7 Troubleshoot problems | X |
| 33.9 Perform software upgrades and fixes | X |

| Unit 34: System Administration and Control | |
|---|---|
| 34.2 Apply data structure concepts to the storage and retrieval of data | X |
| 34.3 Query a database | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |

**AREA OF CERTIFICATION:**

Novell Certified Network Administrator (CNA)

**WHAT IS NOVELL CERTIFIED NETWORK ADMINISTRATOR?**

Certified Network Administrators (CNAs) provide on-site administration for software users in a variety of work environments, including professional offices and small businesses, workgroups or departments, and corporate information services (IS). In short, CNAs handle the day-to-day administration of an installed Novell networking product: intraNetWare, NetWare 3, GroupWise 5 or GroupWise 4. CNA certification is recognized worldwide as the standard of excellence for administering Novell products. Small businesses to corporate IS departments worldwide are using CNAs to provide personalized, on-site administrative support for intraNetWare and GroupWise users. As a CNA, you can provide this level of support in a variety of ways, from assisting users in a workgroup environment to handling entry-level IS help desk calls.

## NOVELL CERTIFIED NETWORK ADMINISTRATOR CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in CNA Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | CNA |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.2 Demonstrate knowledge of the impact of information technology on society | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.4 Demonstrate knowledge of the classes of software associated with information systems | X |
| 1.5 Identify career opportunities in information systems | X |
| 1.6 Explore the future of information technologies | X |
| **Unit 2: Computer Applications** | |
| 2.1 Create documents using word processing software | X |
| 2.3 Create spreadsheets | X |
| 2.5 Create presentations using presentation graphics software | X |
| 2.6 Integrate computer applications | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| 3.2 Access information using electronic sources | X |
| 3.3 Demonstrate proficiency with electronic mail | X |
| **Unit 4: Programming Theory** | |
| 4.1 Demonstrate knowledge of programming language concepts | X |

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| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | X |
| 6.3 Provide support and training | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| 8.3 Evaluate application software packages | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | X |
| 18.3 Demonstrate knowledge of computer architecture and processor types | X |
| 18.4 Demonstrate basic knowledge of computer system architecture | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.7 Explain operation of microprocessor systems | X |
| 18.8 Demonstrate knowledge of peripheral equipment | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | X |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | X |
| 19.8 Provide support and training | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.3 Install network system | X |

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| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.6 Perform network installation procedures | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.6 Manage backup and recovery, both on- and off-site | X |
| 33.7 Troubleshoot problems | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 34: System Administration and Control** | |
| 34.1 Perform general system administration tasks | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |
| **Unit 36: Communication** | |
| 36.1 Apply communication skills | X |
| 36.2 Compose documents | X |
| 36.3 Demonstrate sensitivity in communicating with a diverse workforce | X |
| 36.4 Deliver oral presentations | X |
| 36.5 Build interpersonal skills with individuals and other team members | X |
| **Unit 37: Technical Writing and Documentation** | |
| 37.2 Write technical reports | X |
| 37.3 Conduct technical research | X |
| **Unit 38: Customer Relations** | |
| 38.1 Build customer relations | X |
| 38.2 Perform scheduling functions to meet customers needs | X |
| **Unit 42: Management and Supervision** | |
| 42.1 Maintain a safe working environment | X |
| 42.2 Guide progress in assigned areas of responsibility/accountability | X |
| 42.10 Maintain company security | X |
| **Unit 48: Fundamentals of Electronics Technology** | |
| 48.3 Demonstrate proficiency in working with microcomputer systems | X |

**AREA OF CERTIFICATION:**

Novell Certified Network Engineer (CNE)

**WHAT IS NOVELL CERTIFIED NETWORK ENGINEER?**

Certified Network Engineer training gives you the skills to provide high-end, solutions-based technical support, such as Network planning, installation and configuration; performing system upgrades; improving network printing performance; and managing network databases. You will also gain an indepth knowledge of fundamental IT concepts, including microcomputer platform environments and local operating system concepts (MS DOS and MS Windows). As a CNE, you may specialize in one or more of the following areas: GroupWise 4 and/or GroupWise 5; NetWare 3 – the world's most common networking platform; NetWare 4.11 – with NDS and Internet capabilities; NetWare 5 – the world's newest, most advanced networking platform.

## NOVELL CERTIFIED NETWORK ENGINEER CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in CNE Certification.

**PLEASE NOTE:**

X = competency is addressed

| Unit | CNE |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.2 Demonstrate knowledge of the impact of information technology on society | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.4 Demonstrate knowledge of the classes of software associated with information systems | X |
| 1.5 Identify career opportunities in information systems | X |
| 1.6 Explore the future of information technologies | X |
| **Unit 2: Computer Applications** | |
| 2.1 Create documents using word processing software | X |
| 2.3 Create spreadsheets | X |
| 2.5 Create presentations using presentation graphics software | X |
| 2.6 Integrate computer applications | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| 3.2 Access information using electronic sources | X |
| 3.3 Demonstrate proficiency with electronic mail | X |
| **Unit 4: Programming Theory** | |
| 4.1 Demonstrate knowledge of programming language concepts | X |
| 4.2 Apply the process of algorithm and structured code development | X |

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| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | X |
| 6.3 Provide support and training | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| 8.3 Evaluate application software packages | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 16: Web Page Design** | |
| 16.4 Apply knowledge of web hosting | X |
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | X |
| 18.2 Analyze the computer site environment | X |
| 18.3 Demonstrate knowledge of computer architecture and processor types | X |
| 18.4 Demonstrate basic knowledge of computer system architecture | X |
| 18.5 Demonstrate knowledge of CPU components | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.7 Explain operation of microprocessor systems | X |
| 18.8 Demonstrate knowledge of peripheral equipment | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | X |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.2 Demonstrate knowledge of computer memory | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.7 Perform standard computer backup procedures | X |
| 19.8 Provide support and training | X |
| 19.9 Employ computer system interfaces | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.5 Demonstrate knowledge of network connectivity basics | X |
| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| 20.8 Demonstrate knowledge of communication standards for networks | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |

| | |
|---|---|
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| 22.3 Install network system | X |
| **Unit 23: Wide-Area Networks** | |
| 23.1 Demonstrate knowledge of basic telecommunications and the interconnection of networks | X |
| 23.2 Assess user needs for a wide-area network (WAN) | X |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.4 Perform network analysis, selection, and design | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| 24.12 Explain disaster recovery and business continuance | X |
| **Unit 30: Information Systems (IS) Theory** | |
| 30.1 Demonstrate a basic knowledge of systems theory and quality concepts | X |
| 30.2 Identify system infrastructure | X |
| **Unit 32: Information System Analysis and Design** | |
| 32.2 Initiate a system project | X |
| 32.3 Perform a detailed system investigation and analysis | X |
| 32.4 Design an information system | X |
| 32.5 Develop the information system | X |
| 32.8 Perform management functions related to the planned change | X |
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.6 Manage backup and recovery, both on- and off-site | X |
| 33.7 Troubleshoot problems | X |
| 33.8 Evaluate problem-solving processes and outcomes | X |
| 33.9 Perform software upgrades and fixes | X |
| **Unit 34: System Administration and Control** | |
| 34.1 Perform general system administration tasks | X |
| 34.6 Transfer files between mid-range and microcomputer systems | X |

| | |
|---|---|
| **Unit 35: Project Management** | |
| 35.1 Manage information system project methodologies | X |
| 35.2 Define scope of work to achieve individual and group goals | X |
| 35.3 Develop time and activity plan to achieve objectives | X |
| 35.4 Manage work processes and procedures | X |
| **Unit 36: Communication** | |
| 36.1 Apply communication skills | X |
| 36.2 Compose documents | X |
| 36.3 Demonstrate sensitivity in communicating with a diverse workforce | X |
| 36.4 Deliver oral presentations | X |
| 36.5 Build interpersonal skills with individuals and other team members | X |
| **Unit 37: Technical Writing and Documentation** | |
| 37.1 Evaluate technical writing requirements | X |
| 37.2 Write technical reports | X |
| 37.3 Conduct technical research | X |
| 37.4 Design technical documentation | X |
| 37.5 Develop technical documentation | X |
| **Unit 38: Customer Relations** | |
| 38.1 Build customer relations | X |
| 38.2 Perform scheduling functions to meet customers needs | X |
| **Unit 39: Economic and Business Concepts** | |
| 39.1 Characterize the nature of business | X |
| 39.4 Clarify management concepts | X |
| **Unit 40: Financial Management Functions** | |
| 40.1 Demonstrate knowledge of management's role in operating a business | X |
| **Unit 42: Management and Supervision** | |
| 42.1 Maintain a safe working environment | X |
| 42.2 Guide progress in assigned areas of responsibility/accountability | X |
| 42.10 Maintain company security | X |
| **Unit 48: Fundamentals of Electronics Technology** | |
| 48.3 Demonstrate proficiency in working with microcomputer systems | X |
| 48.4 Demonstrate proficiency in working with computer system architecture | X |
| 48.5 Demonstrate knowledge of the basic elements of communication interfacing | X |
| 48.6 Apply troubleshooting and repair techniques to a microcomputer system | X |
| **Unit 49: Telecommunications** | |
| 49.1 Demonstrate knowledge of transmission line applications | X |
| 49.5 Demonstrate proficiency in working with data communications | X |
| 49.6 Troubleshoot data communications | X |
| 49.7 Demonstrate proficiency in working with fiber optic communications systems | X |

**AREA OF CERTIFICATION:**

Nortel NetKnowledge Certification (NKC)

**WHAT IS NORTEL NETKNOWLEDGE?**

The Nortel NetKnowledge high school curriculum is four one-semester courses for grades 11 and 12. The courses are titled Internetworking Fundamentals, Routing, Switching, and Unified Networks practicum. A+ program completion students will have the opportunity to take a NetKnowledge Certification test at no charge using industry standard proctored electronic exam/technology. In addition, or in lieu of the certification credential, students will have developed communication abilities and a portfolio of supporting network design, implementation and assessment deliverables, and documentation integral to evaluation of each course. Students succeeding with NetKnowledge certification would be eligible for professional certification testing in Nortel's Switching Core Technology and Routing Core Technology.

## NORTEL NETKNOWLEDGE CERTIFICATION CROSSWALK WITH OHIO INFORMATION TECHNOLOGY COMPETENCY PROFILE

The competencies listed below were identified by a panel of industry and education representatives to be addressed in NKC Certification.

**PLEASE NOTE:**

X = competency is addressed  O = competency is partially addressed

| Unit | NKC |
|---|---|
| **Unit 1: Information Technology Basics** | |
| 1.1 Demonstrate basic knowledge of the history of information technology | X |
| 1.2 Demonstrate knowledge of the impact of information technology on society | X |
| 1.3 Demonstrate knowledge of the hardware components associated with information systems | X |
| 1.4 Demonstrate knowledge of the classes of software associated with information systems | X |
| 1.5 Identify career opportunities in information systems | X |
| 1.6 Explore the future of information technologies | X |
| **Unit 2: Computer Applications** | |
| 2.1 Create documents using word processing software | X |
| 2.3 Create spreadsheets | X |
| 2.5 Create presentations using presentation graphics software | X |
| 2.6 Integrate computer applications | X |
| **Unit 3: Data Communications** | |
| 3.1 Demonstrate knowledge of basic data communications components and trends | X |
| 3.2 Access information using electronic sources | X |
| 3.3 Demonstrate proficiency with electronic mail | X |

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|---|---|
| **Unit 6: Computer User Support** | |
| 6.1 Analyze technical support needed | X |
| 6.2 Perform customer service | X |
| 6.3 Provide support and training | X |
| **Unit 8: Software Systems Management** | |
| 8.1 Install/configure software programs | X |
| 8.2 Perform configuration management activities | X |
| **Unit 10: Graphic Design Fundamentals** | |
| 10.1 Demonstrate basic technical art skills (traditional and electronic) | X |
| 10.5 Create computer graphics | X |
| **Unit 15: Internet** | |
| 15.1 Demonstrate basic knowledge of the Internet | X |
| 15.2 Demonstrate advanced knowledge of the Internet | X |
| 15.3 Access the Internet | X |
| 15.4 Utilize Internet services | X |
| **Unit 16: Web Page Design** | |
| 16.1 Demonstrate knowledge of web page basics | X |
| 16.2 Demonstrate knowledge of Internet programming basics | X |
| 16.4 Apply knowledge of web hosting | X |
| 16.5 Create/maintain a basic Internet programming document | X |
| 16.6 Format page layout | X |
| 16.7 Add audio and video to a web page | X |
| 16.8 Link documents | X |
| **Unit 18: Hardware Design, Operation, and Maintenance** | |
| 18.1 Demonstrate knowledge of hardware standards | X |
| 18.2 Analyze the computer site environment | X |
| 18.3 Demonstrate knowledge of computer architecture and processor types | X |
| 18.4 Demonstrate basic knowledge of computer system architecture | X |
| 18.5 Demonstrate knowledge of CPU components | X |
| 18.6 Demonstrate a basic knowledge of connectivity devices | X |
| 18.7 Explain operation of microprocessor systems | X |
| 18.8 Demonstrate knowledge of peripheral equipment | X |
| 18.10 Install computer system (e.g., monitor, keyboard, disk drive, and printer) | X |
| 18.11 Troubleshoot computer systems | X |
| **Unit 19: Operating Systems** | |
| 19.1 Describe system components | X |
| 19.3 Demonstrate knowledge of auxiliary storage | X |
| 19.4 Maintain security requirements | X |
| 19.5 Operate system | X |
| 19.6 Maintain system | X |
| 19.8 Provide support and training | X |
| 19.9 Employ computer system interfaces | X |
| **Unit 20: Networking** | |
| 20.1 Demonstrate knowledge of basic network classifications and topologies | X |
| 20.2 Demonstrate knowledge of local-area network (LAN) trends and issues | X |
| 20.3 Demonstrate knowledge of common network computing platforms | X |
| 20.4 Demonstrate knowledge of LAN physical media | X |
| 20.5 Demonstrate knowledge of network connectivity basics | X |

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|---|---|
| 20.6 Differentiate processes, services, and protocols | X |
| 20.7 Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498) | X |
| 20.8 Demonstrate knowledge of communication standards for networks | X |
| **Unit 21: Network Architectures** | |
| 21.1 Demonstrate knowledge of the basics of network architecture | X |
| 21.2 Demonstrate knowledge of the basics of Ethernet technology | X |
| 21.3 Demonstrate knowledge of the basics of token ring technology | X |
| 21.4 Demonstrate knowledge of the basics of token bus, Fiber Distributed-Data Interface (FDDI), and wireless LAN technology | X |
| 21.5 Demonstrate knowledge of the TCP/IP protocol | X |
| 21.6 Demonstrate knowledge of basic communication protocols | X |
| 21.7 Install basic system architectures using current Windows operating system software | X |
| **Unit 22: Network Operating Systems** | |
| 22.1 Demonstrate knowledge of the general characteristics of network operating systems | X |
| 22.2 Demonstrate knowledge of network operating systems (i.e., Novell NetWare, Windows NT, LINUX, UNIX, IBM Network, AppleTalk) | X |
| 22.3 Install network system | X |
| **Unit 23: Wide-Area Networks** | |
| 23.1 Demonstrate knowledge of basic telecommunications and the interconnection of networks | X |
| 23.2 Assess user needs for a wide-area network (WAN) | X |
| 23.3 Design WAN systems | X |
| **Unit 24: Network Management** | |
| 24.1 Demonstrate knowledge of network management activities and procedures | X |
| 24.2 Demonstrate knowledge of network applications | X |
| 24.3 Solve network applications problems | X |
| 24.4 Perform network analysis, selection, and design | X |
| 24.5 Design network security systems | X |
| 24.6 Perform network installation procedures | X |
| 24.7 Build Ethernet networks | X |
| 24.8 Perform network operation procedures | X |
| 24.9 Perform hardware and desktop support | X |
| 24.10 Perform network administration | X |
| 24.11 Perform network maintenance and diagnostics and testing | X |
| 24.12 Explain disaster recovery and business continuance | X |
| **Unit 25: Basic Mainframe Concepts** | |
| 25.1 Demonstrate knowledge of mainframe operations | X |
| **Unit 30: Information Systems (IS) Theory** | |
| 30.1 Demonstrate a basic knowledge of systems theory and quality concepts | X |
| 30.2 Identify system infrastructure | X |
| 30.4 Compare/contrast individual and collaborative knowledge work | X |
| 30.5 Plan strategies for implementing system | X |
| 30.6 Facilitate measures of achievement | X |
| **Unit 31: Information Systems Management** | |
| 31.1 Conduct organizational planning for information systems | X |
| 31.4 Manage IS subfunctions | X |
| **Unit 32: Information System Analysis and Design** | |
| 32.3 Perform a detailed system investigation and analysis | X |
| 32.4 Design an information system | X |

| | |
|---|---|
| **Unit 33: System Installation and Maintenance** | |
| 33.2 Install system | X |
| 33.3 Perform software configuration and loading | X |
| 33.4 Monitor the information system | X |
| 33.5 Perform system maintenance | X |
| 33.7 Troubleshoot problems | X |
| 33.8 Evaluate problem-solving processes and outcomes | X |
| **Unit 35: Project Management** | |
| 35.1 Manage information system project methodologies | X |
| 35.2 Define scope of work to achieve individual and group goals | X |
| 35.3 Develop time and activity plan to achieve objectives | X |
| 35.4 Manage work processes and procedures | X |
| **Unit 36: Communication** | |
| 36.1 Apply communication skills | X |
| 36.2 Compose documents | X |
| 36.3 Demonstrate sensitivity in communicating with a diverse workforce | X |
| 36.4 Deliver oral presentations | X |
| 36.5 Build interpersonal skills with individuals and other team members | X |
| **Unit 37: Technical Writing and Documentation** | |
| 37.1 Evaluate technical writing requirements | X |
| 37.2 Write technical reports | X |
| 37.3 Conduct technical research | X |
| 37.4 Design technical documentation | X |
| 37.5 Develop technical documentation | X |
| **Unit 38: Customer Relations** | |
| 38.1 Build customer relations | X |
| 38.2 Perform scheduling functions to meet customers needs | X |
| **Unit 42: Management and Supervision** | |
| 42.1 Maintain a safe working environment | X |
| **Unit 47: Basic Electricity** | |
| 47.4 Demonstrate proficiency in working with AC circuits | O |
| **Unit 48: Fundamentals of Electronics Technology** | |
| 48.2 Distinguish between analog and digital phenomena and circuits | X |
| 48.5 Demonstrate knowledge of the basic elements of communication interfacing | X |
| 48.6 Apply troubleshooting and repair techniques to a microcomputer system | X |
| **Unit 49: Telecommunications** | |
| 49.1 Demonstrate knowledge of transmission line applications | X |
| 49.2 Demonstrate proficiency in working with transmitters and receivers | X |
| 49.3 Demonstrate knowledge of various types of multiplexing systems | X |
| 49.5 Demonstrate proficiency in working with data communications | X |
| 49.6 Troubleshoot data communications | X |

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