SONOMA COUNTY OFFICE OF EDUCATION

ROP COURSE OUTLINE

Cisco Networking Semester 1 & 2

Course Description

This is the first of two courses designed to provide students with classroom and laboratory experience in current and emerging networking technology. It will empower them to enter employment and/or further education and training in the computer networking field. Content standards are based on a task analysis of current industry/occupational standards. The first half of the course includes, but is not limited to, safety, networking, network terminology and protocols, network standards, local area networks (LANs), wide area networks (WANs), OSI models, cabling tools, routers, router programming, star topology, Internet protocol (IP) addressing, and network standards. The second half of the course includes, but is not limited to, safety, networking, network terminology and protocols, network standards, LANs, WANs, OSI models, Ethernet, token-ring, fiber-distributed interface, transmission control protocol/internet-protocol (TCP/IP) addressing protocol, dynamic routing, routing, and the network administrator's role and function. Particular emphasis is given to the use of decision-making and problem-solving techniques in applying science, mathematics, communication, and social studies concepts to solve networking problems. In addition, instruction and training are provided in the proper care, maintenance and use of networking software, tools, and equipment and all local, state, and federal safety, building, and environmental codes and regulations. Integrated throughout the course are career preparation standards, which include basic academic skills, communication, interpersonal skills, problem solving, safety, technology, and other employment skills. This course will equip students with the skills to pass the Net+ exam.

CBEDS Title: Telecommunications

CBEDS Number: 4618

Career Development / Workforce Preparation

Course Created:

County Board Approval: _____
(Date)

Course Revised:

California Department of Education Approval: _____
(Date)

Information Services

The information services industry is struggling to recover from significant layoffs and declining demand for infrastructure, equipment and services over the last four years. According to the Sonoma County Economic Development Board's North Bay and Employment report for Fall 2004 the technology industry is beginning to show signs of recovery. Telecom markets are stabilizing with businesses increasing their purchases of telecom equipment and service. In addition, the consumer market for information technology and digital "gadgets" has helped improve demand for information technology products and service. According to the Wall Street Journal, technology convergence is the trend in consumer electronics bundling voice, data, video and internet access in cell phones, portable music players and even home appliances. This trend suggests that information services, both in terms of product development and service and consulting, will remain and grow into a strong industry for potential employment. The trick is to estimate which aspect of information services to focus training.

Computer Applications continues to be the staple of Information service jobs. Nearly any job that is available today requires computer skills. Nearly any job involves the ability to use a computer effectively and manage and share information. Communicating and sharing information are skills listed throughout the occupations outlined in the North Bay Counties Occupational Outlook – 2003-2004. Occupations such as Administrative Assistants, Billing Clerks, Cashiers, Database Administrators, Office Clerks, Customer Service Representatives, and Secretaries all use computers extensively.

Networking and computer technicians are in high demand and enjoy medium to large size occupations. Growth in these occupations is expected to be faster than average with a strong probability of upward movement with further training beyond high school. Sonoma County with its high technology manufacturing has a strong labor market for computer technicians.

Web design and computer graphics are popular fields with volatile job markets. The North Bay Counties Occupational Outlook for 2003-2004 was unable to estimate employment trends for these occupations. However, according to the publication, employers are expecting their hiring in these fields to grow over the next two years. With much of page layout and design work being done in-house, more jobs may require this skill than can be easily estimated.

Digital video and animation are also popular fields with unclear job markets. Certainly, there are high-end jobs and the popular computer gaming industry draws a great deal of computer programmers and animators. However, employment data, especially local employment data, for these fields is hard to find. Traditionally, much of the growth in computer graphics, video and animation has happened as individuals work as private contractors. There is a large demand for digital video and entertainment. Unfortunately, there is little data to document the demand for jobs in the digital video and computer graphics fields.

Given the extent of our information economy, occupations in information services are prevalent. Such training is often considered basic for most occupations.

Cisco Networking Semester 1 & 2

This course is linked directly to occupations in the following industries:

Manufacturing	Utilities
Government	Business

This course is a part of the following Career Pathway

Pathway

Recommended Sequence	Courses
Introductory	Computer Foundations
Skill Building	Cisco Networking: Semester 1 & 2
Advanced Skill	Cisco Networking: Semester 3 & 4

Core Academic Standards

This course addresses the following Core Academic Standards

Instructional Unit: Career Preparation:

English Language Arts Standards:

Grade 8: Reading – 1.3: Use the word meanings within the appropriate context and show ability to verify those meanings by definition, restatement, example, comparison, or contrast.

Grade 8: Reading – 2.1: Compare and contrast the features and elements of consumer material to gain meaning from documents (e.g., warranties, contracts, product information, instructional materials).

Grade 8: Reading – 2.6: Use information from a variety of consumer, workplace, and public documents to explain a situation or decision and to solve a problem.

Grade 8 Writing – 1.3: Support theses or conclusions with analogies, paraphrases, quotations, opinions from authorities, comparisons, and similar devices.

Grade 8 Writing – 2.5: Write documents related to career development, including simple business letters and job applications:

a. Present information purposefully and succinctly and meet the needs of the intended audience.
b. Follow the conventional format for the type of document (e.g., letter of inquiry, memorandum).

Grade 8 Language Conventions -- 1.4: *Grammar:* Edit written manuscripts to ensure that correct grammar is used.

Grade 8 Language Conventions -- 1.5: *Punctuation and Capitalization:* Use correct punctuation and capitalization.

Grade 8 Language Conventions -- 1.6: *Spelling:* Use correct spelling conventions.

Grade 8 Listening and Speaking -- 1.2: *Comprehension:* Paraphrase a speaker's purpose and point of view and ask relevant questions concerning the speaker's content, delivery, and purpose.

Grade 8 Listening and Speaking -- 1.3: *Organization and Delivery of Oral Communication:* Organize information to achieve particular purposes by matching the message, vocabulary, voice modulation, expression, and tone to the audience and purpose.

Grade 9/10 Reading -- 2.1: *Structural Features of Informational Materials:* Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.

Grade 9/10 Reading-- 2.3: *Comprehension and Analysis of grade-Level-Appropriate Text:* Generate relevant questions about readings on issues that can be researched.

Grade 9/10 Reading – 2.6: Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Grade 9/10 Writing – 2.5: Write business letters:

a. Provide clear and purposeful information and address the intended audience appropriately.
b. Use appropriate vocabulary, tone, and style to take into account the nature of the relationship with, and the knowledge and interests of, the recipients.
c. Highlight central ideas or images.
d. Follow a conventional style with page formats, fonts, and spacing that contribute to the documents' readability and impact.

Grade 9/10 Language Conventions –1.4: *Manuscript Form:* Produce legible work that shows accurate spelling and correct use of the conventions of punctuation and capitalization.

Grade 9/10 Listening and Speaking – 1.1: *Comprehension:* Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.

Grade 9/10 Listening and Speaking – 2.3: Apply appropriate interviewing techniques:

a. Prepare and ask relevant questions.
b. Make notes of responses.
c. Use language that conveys maturity, sensitivity, and respect.
d. Respond correctly and effectively to questions.
e. Demonstrate knowledge of the subject or organization.
f. Compile and report responses.
g. Evaluate the effectiveness of the interview.

Grade 11/12 Reading –2.3: *Comprehension and Analysis of Grade-Level-Appropriate Text*: Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

Grade 11/12 Writing – 2.5: Write job applications and resumés:

a. Provide clear and purposeful information and address the intended audience appropriately.
b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.
c. Modify the tone to fit the purpose and audience.
d. Follow the conventional style for that type of document (e.g., resumé, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.

Grade 11/12 Language Conventions – 1.2: Produce legible work that shows accurate spelling and correct punctuation and capitalization.

Math Standards:

Grade 7: Number Sense – 1.2: Add, subtract, multiply, and divide rational numbers to whole-number powers.

Grade 7: Number Sense – 1.3: Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.

Grade 7: Number Sense – 1.7: Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest.

Grade 7: Mathematical Reasoning – 1.1: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

Grade 7: Mathematical Reasoning – 1.3: Determine when and how to break a problem into simpler parts.

Grade 7: Mathematical Reasoning – 2.1: Use estimation to verify the reasonableness of calculated results.

Grade 7: Mathematical Reasoning – 2.7: Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

Grade 7: Mathematical Reasoning – 2.8: Make precise calculations and check the validity of the results from the context of the problem.

Grade 7: Mathematical Reasoning – 3.1: Evaluate the reasonableness of the solution in the context of the original situation.

Instructional Unit: Cisco Networking Semester 1 & 2

English Language Arts Standards:

Grade 9-10: Reading – 2.6: Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Grade 9-10: Writing – 1.8: Design and publish documents by using advanced publishing software and graphic programs.

Grade 9-10: Writing – 2.3: Write expository compositions, including analytical essays and research reports:

d. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.

Grade 9-10: Writing – 2.6: Write technical documents (e.g., a manual on rules of behavior for conflict resolution, procedures for conducting a meeting, minutes of a meeting):

a. Report information and convey ideas logically and correctly.
b. Offer detailed and accurate specifications.
c. Include scenarios, definitions, and examples to aid comprehension (e.g., troubleshooting guide).
d. Anticipate readers' problems, mistakes, and misunderstandings.

Grade 11-12: Writing – 1.8: Integrate databases, graphics, and spreadsheets into word-processed documents.

Grade 11-12: Writing – 2.5: Write job applications and resumes:

a. Provide clear and purposeful information and address the intended audience appropriately.
b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.
c. Modify the tone to fit the purpose and audience.
d. Follow the conventional style for that type of document (e.g., resume, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.

Grade 11-12: Listening and Speaking – 2.4: Deliver multimedia presentations:

a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.
b. Select an appropriate medium for each element of the presentation.
c. Use the selected media skillfully, editing appropriately and monitoring for quality.

d. Test the audience's response and revise the presentation accordingly.

Grade 9-10: Listening and Speaking – 1.1: Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.

Grade 9-10: Writing – 1.1: Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.

Grade 9-10: Writing – 1.2: Uses precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.

Grade 9-10: Writing – 1.9: Revise writing to improve the logic and coherence of the organization and controlling perspective, the precision of word choice, and the tone by taking into consideration the audience, purpose, and formality of the context.

Grade 9-10: Writing Applications – 2.1: Write biographical or autobiographical narratives or short stories:

a. Relate a sequence of events and communicate the significance of the events to the audience.
b. Locate scenes and incidents in specific places.
c. Describe with concrete sensory details the sights, sounds, and smells of a scene and the specific actions, movements, gestures, and feelings of the characters; use interior monologue to depict the characters' feelings.
d. Pace the presentation of actions to accommodate changes in time and mood.
e. Make effective use of descriptions of appearance, images, shifting perspectives, and sensory details.

Grade 9-10: Writing Applications – 2.3: Write expository compositions, including analytical essays and research reports:

a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
b. Convey information and ideas from primary and secondary sources accurately and coherently.
c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
d. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.
e. Anticipate and address readers' potential misunderstandings, biases, and expectations.
f. Use technical terms and notations accurately.

Grade 9-10: Writing Applications – 2.4: Write persuasive compositions:

a. Structure ideas and arguments in a sustained and logical fashion.
b. Use specific rhetorical devices to support assertions (e.g., appeal to logic through reasoning; appeal to emotion or ethical belief; relate a personal anecdote, case study, or analogy).
c. Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, and expressions of commonly accepted beliefs and logical reasoning.
d. Address readers' concerns, counterclaims, biases, and expectations.

Grade 11-12: Writing – 1.1: Demonstrate an understanding of the elements of discourse (e.g., purpose, speaker, audience, form) when completing narrative, expository, persuasive, or descriptive writing assignments.

Grade 11-12: Writing – 1.2: Use point of view, characterization, style (e.g., use of irony), and related elements for specific rhetorical and aesthetic purposes.

Grade 11-12: Writing – 1.3: Structure ideas and arguments in a sustained, persuasive, and sophisticated way and support them with precise and relevant examples.

Grade 11-12: Writing – 1.4: Enhance meaning by employing rhetorical devices, including the extended use of parallelism, repetition, and analogy; the incorporation of visual aids (e.g., graphs, tables, pictures); and the issuance of a call for action.

Grade 11-12: Writing – 1.5: Use language in natural, fresh, and vivid ways to establish a specific tone.

Grade 11-12: Writing – 1.6: Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

Grade 11-12: Writing – 1.7: Use systematic strategies to organize and record information (e.g., anecdotal scripting, annotated bibliographies).

Grade 11-12: Writing – 1.8: Integrate databases, graphics, and spreadsheets into word-processed documents

Grade 9-10: Reading – 2.1: Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.

Grade 9-10: Writing – 2.6: Write technical documents (e.g., a manual on rules of behavior for conflict resolution, procedures for conducting a meeting, minutes of a meeting):

a. Report information and convey ideas logically and correctly.
b. Offer detailed and accurate specifications.
c. Include scenarios, definitions, and examples to aid comprehension (e.g., troubleshooting guide).
d. Anticipate readers' problems, mistakes, and misunderstandings.

Grade 9-10: Listening and Speaking – 1.3: Choose logical patterns of organization (e.g., chronological, topical, cause and effect) to inform and to persuade, by soliciting agreement or action, or to unite audiences behind a common belief or cause.

Grade 9-10: Listening and Speaking – 1.4: Choose appropriate techniques for developing the introduction and conclusion (e.g., by using literary quotations, anecdotes, references to authoritative sources).

Grade 9-10: Listening and Speaking – 1.5: Recognize and use elements of classical speech forms (e.g., introduction, first and second transitions, body, conclusion) in formulating rational arguments and applying the art of persuasion and debate.

Grade 9-10: Listening and Speaking – 1.6: Present and advance a clear thesis statement and choose appropriate types of proof (e.g., statistics, testimony, specific instances) that meet standard tests for evidence, including credibility, validity, and relevance.

Grade 9-10: Listening and Speaking – 1.7: Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

Grade 9-10: Listening and Speaking – 1.8: Produce concise notes for extemporaneous delivery.

Grade 11-12: Writing – 1.3: Structure ideas and arguments in a sustained, persuasive, and sophisticated way and support them with precise and relevant examples.

Grade 11-12: Writing – 1.5: Use language in natural, fresh, and vivid ways to establish a specific tone.

Grade 11-12: Writing – 1.6: Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

Grade 11-12: Writing – 1.7: Use systematic strategies to organize and record information (e.g., anecdotal scripting, annotated bibliographies).

Grade 11-12: Writing – 1.8: Integrate databases, graphics, and spreadsheets into word-processed documents.

Math Standards:

Grade 8-12: Algebra I – 13.0: Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.

Grade 8-12: Algebra I – 24.0: Students use and know simple aspects of a logical argument:

Grade 8-12: Algebra I – 24.1: Students explain the difference between inductive and deductive reasoning and identify and provide examples of each.

Grade 8-12: Algebra I – 24.2: Students identify the hypothesis and conclusion in logical deduction.

Grade 8-12: Algebra I – 24.3: Students use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion.

Grade 8-12: Algebra I – 25.0: Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements:

Grade 8-12: Algebra I – 25.1: Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.

Grade 8-12: Algebra I – 25.2: Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.

Grade 8-12: Algebra I – 25.3: Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.

Grade 7: Number Sense – 1.1: Read, write, and compare rational numbers in scientific notation (positive and negative powers of 10) with approximate numbers using scientific notation.

Grade 7: Number Sense – 1.3: Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.

Social Science Standards:

Grade 10: World History – 10.11: Students analyze the integration of countries into the world economy and the information, technological, and communications revolutions (e.g., television, satellites, computers).

Model Curriculum Standards for Cisco Networking Semester 1 & 2

This course addresses the following Business Education and Information Technology Model Curriculum Standards

Business Core 1.0

1.3 Career Preparation, Job Acquisition and Retention (C):
Students will understand the career preparation and job acquisition skills required for employment, professional growth, and employment transitions in the field of business occupations. They will demonstrate competency by researching career options, applying job acquisition skills,
preparing job search documentation, and modeling appropriate workplace demeanor.

- 1.3.1 Career Exploration–explore career opportunities and projected trends; investigate required education, training and experience; and develop an individual education plan for life long learning
- 1.3.2 Employment Transitions–analyze the effects of job changes, including the impact of unemployment
- 1.3.3 Goal Setting–identify steps for setting goals and write personal goals and objectives
- 1.3.4 Interest Assessment–examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities
- 1.3.5 Job Acquisition–develop job acquisition documents and interview skills
- 1.3.6 Job Retention–identify appropriate work attitudes and behaviors

1.5 Employability Skills (C):
Students will understand the factors essential to a productive workforce in a culturally diverse global environment. They will demonstrate competency by identifying the skills, which positively affect productivity.

- 1.5.1 Adapting to Change–provide a workplace example of a constantly changing environment and discuss how employees should incorporate lifelong learning as a career goal
- 1.5.2 Conflict Resolution–demonstrate skills necessary to resolve disagreements in a professional manner
- 1.5.3 Diversity–describe and compare cultural differences as related to work styles
- 1.5.4 Occupational Safety–discuss safety practices and develop a plan to maintain a work environment in a safe and secure manner
- 1.5.5 Positive Attitude–role play a work situation to demonstrate positive working relationships with customers, employers and employees
- 1.5.6 Teamwork–develop the ability to work in teams by participating in group activities
- 1.5.7 Time Management–prioritize work to fulfill responsibilities, meet deadlines, and achieve personal satisfaction
- 1.5.8 Work Ethics–define ethics and explain how standards and scruples affect human relations

Information Technology Standards:

I. Information Technology: Students will understand information technology concepts necessary to function in a rapidly changing technological, global society. They will demonstrate competency by appropriately using a variety of resources to develop, access, modify, manage and provide information effectively.

- I.c Computer and Communications Systems – use operating systems, hardware and peripherals, integrating communication tools and appropriate resources, to share, store and manage information
- I.d Computer Applications – identify, select, and use a variety of business and industry standard applications software; discuss emerging technology trends

IV. Network Communications: Students will understand the concepts, systems, and business models necessary to install, create, and manage diverse types of communication technologies and networking systems. They will demonstrate competency by performing tasks related to the creation, installation, management, and security of a chosen networking system.

- IV.d Emerging Technology and Trends – discuss emerging products, services, and business models in relation to the creation, setup, and management of network communication products and services
- IV.e Media Types – identify, evaluate, create, and process voice and data transmissions
- IV.f Network and Systems Administration – analyze, manage, and maintain various types of electronic networks
- IV.g Network Communication Applications – describe and illustrate appropriate use of communication services, products, and applications
- IV.h Network Communication Infrastructure – evaluate, select, and configure compatible systems across various platforms and media types
- IV.i Resource Management – discuss the effective management of human, financial, and communications resources from the standpoint of both a user and a provider
- IV.j Security Monitoring and Investigation – classify appropriate monitoring devices and procedures for quick identification, and prevention of security violations; describe investigative procedures to follow
- IV.k Security Program – develop policies and procedures including user agreements, incident reporting, and recovery for users; design orientation and training programs to educate technicians and end users
- IV.l Security Risk Assessment – identify potential risks and entrance points including internal and external risks, and select appropriate hardware and software including firewalls, monitoring, and antivirus protection

IV.m Standards and Protocol – analyze implications of protocols and international standards and discuss their impact on data transmission

IV.n Topology – diagram physical and logical layouts of network communication systems

IV.o Training – provide information and instruction to users that will enable them to utilize network communication systems

IV.p Troubleshooting – identify problems, develop appropriate methods and tools for resolving problems, and implement solutions

Course Outline

Sonoma County Office of Education
Career Development / Workforce Preparation

This course outline is presented in the state approved format - 2004

Cisco Networking
Semester 1 & 2

COURSE OUTLINE

1. Course Title: Cisco Networking: Semester 1 & 2
2. CBEDS Title: Telecommunications
3. CBEDS Number: 4618
4. Job Titles:

Network Support Specialist Network Control Technician LAN/WAN Technicians Network Specialists Network Systems Technician Cisco-Certified Network Technician

5. Course Description:

This is the first of two courses designed to provide students with classroom and laboratory experience in current and emerging networking technology. It will empower them to enter employment and/or further education and training in the computer networking field. Content standards are based on a task analysis of current industry/occupational standards. The first half of the course includes, but is not limited to, safety, networking, network terminology and protocols, network standards, local area networks (LANs), wide area networks (WANs), OSI models, cabling tools, routers, router programming, star topology, Internet protocol (IP) addressing, and network standards. The second half of the course includes, but is not limited to, safety, networking, network terminology and protocols, network standards, LANs, WANs, OSI models, Ethernet, token-ring, fiber-distributed interface, transmission control protocol/internet-protocol (TCP/IP) addressing protocol, dynamic routing, routing, and the network administrator's role and function. Particular emphasis is given to the use of decision-making and problem-solving techniques in applying science, mathematics, communication, and social studies concepts to solve networking problems. In addition, instruction and training are provided in the proper care, maintenance and use of networking software, tools, and equipment and all local, state, and federal safety, building, and environmental codes and regulations. Integrated throughout the course are career preparation standards, which include basic academic skills, communication, interpersonal skills, problem solving, safety, technology, and other employment skills. This course will equip students with the skills to pass the Net+ exam.

Student Outcomes and Objectives:

Upon Completion for this course students will have an understanding of the following:

<u>Networking basics</u>

- Computer hardware and software, electricity, networking terminology, and protocols.
- LANs and WANs, Open Systems Interconnection (OSI) model, Ethernet, and Internet Protocol (IP) addressing.
- Design and documentation of a basic network and structured cabling.
- Network-to-network communications.

<u>Routers and Routing Basics</u>

- Router user interfaces, components and configurations.
- Basics of IOS versions, naming and software backup
- TCP/IP Protocol Suite and IP addressing and subnetting
- Interior routing protocols – RIP, IGRP

Pathway

Recommended Sequence	Courses
Introductory	Computer Foundations
Skill Building	Cisco Networking: Semester 1 & 2
Advanced Skill	Cisco Networking: Semester 3 & 4

6. Hours: *Students receive up to 180 hours of classroom instruction*

7. Prerequisites: Computer Foundations

8. Date (of creation/revision): December 2004

9. Course Outline

COURSE OUTLINE

Upon successful completion of this course, students will be able to demonstrate the following skills necessary for entry-level employment.

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
I. CAREER PREPARATION STANDARDS A. Understand how personal skill development (including positive attitude, honesty, self-confidence, work ethic, time management, and other positive traits) affects employability. 1. Demonstrate an understanding of classroom policies and procedures. 2. Define workplace ethics and explain the importance of ethical standards and confidentiality in the business environment. 3. Discuss importance of the following personal skills in the work environment: a. positive attitude b. self-confidence c. honesty d. perseverance e. self-discipline 4. Identify acceptable workplace attire. 5. Prioritize tasks and meet deadlines. 6. Discuss the importance of lifelong learning. B. Understand principles of effective interpersonal skills, including group dynamics, conflict resolution, and negotiation. 1. Identify and discuss the key concepts of group dynamics. 2. Identify strategies for solving conflict in the workplace. a. setting limits that build mutual respect b. building win/win relationships c. avoiding manipulation, stereotyping, harassment, and intimidation d. resolving conflicting job assignments 3. Work cooperatively, share responsibilities, accept supervision, and assume leadership roles. 4. Demonstrate cooperative working relationships and proper etiquette across gender and cultural groups. C. Understand the importance of good academic skills, critical thinking and problem-solving skills in the workplace. 1. Recognize the importance of good reading, writing, math and computer skills in the work environment and implement a plan for self-improvement as needed. 2. Read, write, and give directions. 3. Exhibit critical and creative thinking skills. 4. Recognize problem situations; identify, locate and organize needed information or data; and propose, evaluate, and select from alternative solutions. 5. Use appropriate reference materials.	10 Additional hours are integrated throughout the course.	Business Core; 1.3 & 1.5	Language Arts (8) R 1.3, 2.6 W1.3, 2.5. LC 1.4,1.5, 1.6 LS1.2, 1.3, (9/10) R2.1,2.3,2 W2.5 LC1.4 LS 1.1, 2.3 (11/12) R2.3 W2.5 LC1.2 Math (7) NS1.2, 1.7 MR 1.1,1.3 2.7,2.8, 3.1	**Lang. Arts R 8.2.1** **(9/10) R 2.1, 2.3 W2.5** **Math (7) NS 1.2, 1.3, 1.7 MR 1.1, 2.1, 3.1**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
I. CAREER PREPARATION STANDARDS (Cont.) D. Understand principles of effective communication. 1. Read and implement written instructions, technical manuals, written communication, and reference books. 2. Present a positive image through verbal and nonverbal communication through use of appropriate methods. 3. Demonstrate active listening through oral and written feedback. 4. Demonstrate proper etiquette in workplace communications. 5. Demonstrate writing/editing skills as follows: a. Write, proofread, and edit workplace documents. b. Use correct grammar, punctuation, capitalization, vocabulary, and spelling. c. Select and use appropriate forms of technology for communication. 6. Exhibit a proficiency in the use of commonly used reference books. E. Understand occupational safety issues, including avoidance of physical hazards. 1. Discuss and implement good safety practices, including: a. avoidance and reporting of physical hazards in the work environment b. safe operation of equipment 2. Apply sound ergonomic principles in organizing one's work space. F. Understand career paths and strategies for obtaining employment. 1. Identify career opportunities, projected trends, and required education, training, and experience. 2. Define scope of practice. 3. Explain the role of professional organizations and their benefits. 4. Explain industry certifications and the employment benefits associated with attaining certification. 5. Identify further recommended training. 7. Identify related career pathways and their requirements. G. Understand and adapt to changing technology. 1. Identify and demonstrate use of computer hardware and peripherals. 2. Identify common computer software used in Technology. 3. Understand the importance of lifelong learning in adapting to changing technology. H. Understand the importance of ethics in information technology fields. 1. Discuss the social and ethical responsibilities of having access to information. 2. Discuss rights to privacy in regard to information. 3. Understand that copyright violations constitute theft. 4. Discuss copyright laws and distinguish copyright violations in a variety of situations. 5. Demonstrate ethical choices in workplace situations. 6. Distinguish between First Amendment freedoms and access to information.				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
II. THE BASICS OF COMPUTING A. Demonstrate an understanding of the basics of computer hardware 1. Recognize name, and state the purposes of all major components of a Personal Computer (PC) 2. Describe information flow in an idealized computer 3. Explain the relationship of Network Interface Card (NICs) to PCs 4. Compare PC components with laptop computer components B. Demonstrate an understanding of the basics of computer software 1. Name the major parameters of software 2. Configure TCP/IP parameters that allow a PC to communicate with a network 3. Demonstrate web browser literacy 4. Troubleshoot common hardware and software problems C. Demonstrate understanding of basic networking terminology 1. Define networks and networking 2. Give examples of data networks 3. Recognize the problems that have been solved by networking and the resulting need for standards 4. Define LAN 5. Define WAN D. Demonstrate understanding of the binary number system 1. Explain how binary numbers represent alphanumeric data 2. Define the units that are used to measure quantity of information 3. Demonstrate ability to work with the base 10 (decimal) number system 4. Demonstrate ability to work with the base 2 (binary) number system 5. Convert decimal numbers to binary numbers 6. Convert binary numbers to decimal numbers	4	Info Tech; Info Tech; I.c,d	ELA 9-10; R 2.6 W; 1.8, 2.3d, 2.6 ELA 11-12; W; 1.8, 2.5 LS; 2.4 M 8-12; A1; 25	**ELA 8; R; 2.1** **M. 6; SDP 1.1, 2.5, 3.1, 3.3, 3.5** **M. 7; MR; 1.1, 1.2, 2.1,2.3, 2.4, 3.1,3.3**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
E. Demonstrate understanding of digital bandwidth 1. Define digital bandwidth in terms of bits, kilobits, megabits, and gigabits per second 2. use three analogies to describe digital bandwidth 3. Explain the reason for different media bandwidths 4. Define data throughput and relate it to digital bandwidth 5. Perform simple calculations of data transfer 6. List five reasons for learning about bandwidth				
III. THE OSI MODEL A. Demonstrate an understanding of a general model of communication in terms of layers 1. Describe how to use the concept of layers to analyze problems in the flow of materials and ideas 2. Describe source, destination, and data packet 3. Define medium 4. Define protocol 5. Describe the evolution of OSI networking standards B. Demonstrate understanding of the OSI model 1. State the purpose of the OSI reference model 2. Identify each of the seven layers of an OSI model 3. Describe each of the seven layers of an OSI model 4. Define encapsulation 5. Identify data names at each layer (segment/packet/frame/bits) of the OSI model C. Compare and contrast the OSI model with the TCP/IP model 1. Describe the importance of the TCP/IP model 2. Name and describe the layers of the TCP/IP model 3. Explain the protocol graph for TCP/IP 4. Compare the OSI model with the TCP/IP model, layer by layer	6			**ELA 9-10; R; 2.1 WO; 1.1-1.5**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
IV. LOCAL AREA NETWORKS (LANS) A. Demonstrate understanding of basic LAN Devices 1. Explain the concept of a topology 2. Describe the symbol, function, appearance, and OSI layer of computers, clients, servers, relational databases, and printers 3. Describe the symbol, function, purpose, and OSI layer of network interface cards (NICs) in a LAN 4. Describe the symbol, function, appearance, and OSI layer of media in a LAN 5. Describe the symbol, function, appearance, and OSI layer of a repeater, as it applies to a LAN 6. Describe the symbol, function, appearance, and OSI layer of a hub, as it applies to a LAN 7. Describe the symbol, function, appearance, and OSI layer of a bridge, as it applies to a LAN 8. Describe the symbol, function, appearance, and OSI layer of a switch, as it applies to a LAN 9. Describe the symbol, function, appearance, and OSI layer of a router, as it applies to a LAN 10. Describe the symbol, function, appearance, and OSI layer of a cloud 11. Describe the symbol, function, appearance, and OSI layer of network segments B. Demonstrate understanding of the evolution of network devices 1. Describe the evolution of network devices as they relate to the evolution of computers 2. Describe specific milestones in the history of networking 3. Explain how the evolution of networking devicews can be viewed as progressing through OSI layers C. Demonstrate understanding of the basics of data flow through LANs 1. Explain encapsulation and packets 2. Explain packet flow through Layer 1 devices 3. Explain packet flow through Layer 2 devices 4. Explain packet flow through Layer 3 devices 5. Explain packet flow through clouds and through Layer 1-7 devices 6. Describe the path of a data packet as it travels through all seven layers of a LAN	4	Info Tech; Network Comm; IV.d- p	ELA 9-10; LS; 1.1 M 8-12; A1 13.0, 24.0, 25.0	**ELA 9-10; R; 2.3-2.6** **M7; MG; 1.2 MR; 1.1, 3.1, 3.3** **A1 5.0, 10.0, 15.0**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
D. Demonstrate understanding of the building of LANs 1. Demonstrate readiness to build a small network 2. Demonstrate ability to build, configure, and share files on a two-node network with a cross-connect cable 3. Demonstrate ability to build and configures a four-node hubbed network with Internet access through an internet service provider (ISP)				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
V. LAYER 1: ELECTRONICS AND SIGNALS A. Demonstrate an understanding of the basics of electricity 1. Draw a diagram and write a description of a helium atom, including electrons, protons, and neutrons 2. Explain the forces that create stable atoms 3. Draw a diagram and write a description of static electricity 4. Describe electrical current, including specific conductors, semiconductors, and insulators 5. Define the following: voltage, current, resistance, AC, DC, impedance, circuit, and ground 6. Apply the water analogy to the diagram: voltage (water level), resistance (tap), and current (flowing water) 7. Create graphs that compare AC and DC voltage and time 8. Label the axes and signals as they would appear on an oscilloscope 9. Demonstrate the construction of and test a simple series electrical circuit 10. Explain why and how networking equipment should be grounded 11. Demonstrate a working knowledge of electrical vocabulary B. Demonstrate an understanding of the basics of digital multimeters 1. Demonstrate safe handling and use of the multimeters 2. Use the multimeter to make resistance measurements 3. Use the multimeter to make voltage measurements 4. build a simple series circuit on which to perform measurements 5. Demonstrate the construction of a simple electrical communication system C. Demonstrate basic understanding of signals and noise in communication systems 1. Compare and contrast analog and digital signals	6		ELA 9-10; W; 1.1, 1.2, 1.9 WA; 2.1, 2.3, 2.4 ELA 11-12; W; 1.1–1.8 S. 9-12; Physics; 5a,b,c,e,f, g & h	

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
2. Explain how digital signals can be built by analog signals 3. Recognize and define one bit on a physical medium 4. Explain propagation of network signals 5. Recognize and define attenuation as it applies to networking 6. Recognize and define reflection as it pertains to networking 7. Recognize and define noise 8. Recognize and describe the following timing issues: dispersion, jitter, and latency 9. Recognize and define collision 10. Explain the relationship of one bit to a message E. Demonstrate basic understanding the encoding of networking signals 1. Explain that throughout history messages (data) have been encoded for long distance communications 2. Describe modulation and encoding 3. Explain how messages can be encoded as voltages on copper 4. Explain how messages can be encoded as guided light 5. Explain how messages can be encoded as radiated EM waves			S. 9-12; Physics; 4a,b,c,d,e & f	

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
VI. LAYER 1: MEDIA, CONNECTIONS, AND COLLISIONS A. Demonstrate understanding of the most common LAN media 1. Explain the characteristics of a shielded twisted pair (STP) 2. Explain the characteristics of an unshielded twisted pair (UTP) 3. Explain the characteristics of coaxial cable 4. Explain the characteristics of optical fiber a. Reflection b. Refractions c. Multimode Fiber d. Single-mode Fiber e. Installation, care & testing 5. Explain why wireless communication requires no medium a. Wireless Devices b. Standards c. Authentication d. Wireless Security B. Demonstrate understanding of cable specification and termination 1. Explain the need for LAN media 2. Explain the importance of the EIA/TIA standards 3. Explain the details of EIA/TIA 568-B 4. Recognize a wide variety of networking media and terminations C. Demonstrate the process of making and testing cable 1. Demonstrate cable testing (Ethernet 10Base-T EIA/TIA 568-B) on functional, intermittent, and faulty cables using a patch cable tester 2. Demonstrate how to make a straight-through patch cable (Ethernet 10Base-T RJ-45 568-B) 3. Demonstrate how to make a console patch cable (Ethernet 10Base-TRJ-45 568-B) 4. Demonstrate how to make a cross-connect cable (Ethernet 10Base-T RJ-45 568-B) 5. Describe the features of an advanced cable tester 6. Perform cable identification experiments by using an advanced cable tester 7. Perform length experiments with an advanced cable tester	11		ELA 9-10; R; 2.1 ELA 11-12; R; 2.3 M. 7; 1.1, 1.3	

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
D. Understand Layer 1 components and devices 1. Understand the importance of Ethernet 10Base-T 2. Recognize and state the purpose of connectors (plugs) 3. Recognize and explain the purpose of cabling 4. Recognize and describe the purpose of jacks 5. Recognize and describe the purpose of patch panels 6. Recognize and describe the purpose of transceivers 7. Recognize and describe the purpose of repeaters 8. Recognize and state the purpose of multiport repeaters (hubs) 9. Explain how all of these devices function at OSI Layer 1 E. Demonstrate understanding of collisions and collision domains in shared layer environments 1. Compare a shared media environment with other types of networks 2. Explain when and where collisions occur and equate shared media environment with collision domain 3. Describe what happens to the signal in a collision 4. Explain why collisions are a natural function of shared media environments and collision domains 5. Explain the basic situation of shared access as a collision domain 6. Explain how repeaters extend collision domains 7. Explain how hubs extend collision domains 8. Explain how hubs and repeaters together form one large collision domain 9. Explain the four-repeater rule 10. Describe three ways that segmentation of collision domains can be achieved				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
F. Explain the basic topologies used in networking 1. Explain what the word “topology” means in networking 2. Draw and explain the linear bus network topology 3. Draw and explain the ring network topology 4. Draw and explain the dual ring network topology 5. Draw and explain the star network topology 6. Draw and explain the extended star network topology 7. Draw and explain the tree network topology 8. Draw and explain the irregular network topology 9. Draw and explain the (mesh) network topology 10. Draw and explain the cellular network topology				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
VII. LAYER 2: CONCEPTS A. Demonstrate understanding of Layer 2 LAN standards 1. Explain the purpose of Layer 2 2. Compare and contrast OSI Layers 1 and 2 with various LAN standards 3. Explain why two parts of the Institute of Electrical and Electronics Engineers (IEEEs) model appear to contradict the OSI model 4. Describe the function of the logical link control (LLC) 5. Explain the purpose of the media access control (MAC) sublayer 6. Recognize that LLC is only one of the four essential concepts of Layer 2 B. Understand hexadecimal numbers in Layer 2 naming 1. Explain how hexadecimal numbers are used to represent MAC addresses 2. Demonstrate basic knowledge of a hexadecimal numbering system, including place, value, and exponents 3. Convert decimal numbers to hexadecimal numbers 4. Convert hexadecimal numbers to decimal numbers 5. Describe a variety of methods for working with hexadecimal and binary numbers C. Understand MAC Addressing in Layer 2 naming 1. Explain how the data link layer requires identifiers for computers 2. Explain that in any networkingdevice the unique identifier (MAC) resides on the NIC 3. Explain how the NIC is constantly sampling the cable for destination MAC addresses that match its own 4. Explain how Layer 2 addressing is partly done by encapsulation and decapsulation (relating it to the OSI model) 5. Explain the main limitation of MAC addressing	5		SS 10; WH; 10.11	

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
D. Demonstrate understanding of framing 1. Explain why framing is necessary 2. Compare diagrams of bits and frames 3. Describe three analogies for frames 4. Diagram a generic frame 5. Describe how frames start 6. Describe the address fields of frames 7. Describe length/type fields of frames 8. Describe the data in frames 9. Describe three ways to deal with frame errors 10. Describe how frames end F. Demonstrate understanding of MAC 1. Define MAC 2. List three analogies for MAC 3. Define deterministic MAC protocols 4. Define nondeterministic (contention) MAC protocols 5. Describe three specific technical implementations and their MAC				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
VIII. LAYER 2: TECHNOLOGIES A. Explain the basics of token-ring 1. Give an overview of token-ring and its variants 2. Describe the token-ring frame format 3. Describe the token-ring media access control method 4. Describe token-ring signaling 5. Describe token-ring media and physical topologies B. Demonstrate a basic understanding of fiber-distributed data interface (FDDI) 1. Give an overview of FDDI and its variants 2. Describe the FDDI format 3. Describe the FDDI media access control method 4. Describe FDDI signaling 5. Describe FDDI media C. Demonstrate a thorough understanding of Ethernet and IEEE 802.3 1. Compare and contrast Ethernet and IEEE 802.3 2. Describe the Ethernet family tree 3. Describe the Ethernet frame format 4. Describe the Ethernet media access control method 5. Describe Ethernet signaling 6. Describe Ethernet 10Base-T media and topologies D. Explain function and operation of Layer 2 devices 1. Describe NICs 2. Explain how NIC cards perform Layer 2 operations 3. Describe bridges 4. Explain how bridges perform Layer 2 operations 5. Describe switches 6. Explain how switches perform Layer 2 operations E. Explain effects of Layer 2 devices on data flow 1. Explain Ethernet LAN segmentation 2. Explain segmentation of a collision domain by bridges 3. Explain segmentation of a collision domain by switches 4. Explain domain by routers 5. Explain segmentation by bridges, switches, and routers in the teaching of topology	4			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
F. Demonstrate a basic understanding of Ether net 10Base-T troubleshooting 1. Draw a diagram of the process for troubleshooting workstations 2. Explain basic functions of network inspector (NI) software 3. Recognize signs of possible network troubles and apply the isolation process 4. Use NI software to perform timed troubleshooting of Ethernet networks with multiple-induced Layer 2 problems 5. Perform timed troubleshooting of Ethernet networks with unknown problems				
IX. DESIGN AND DOCUMENTATION A. Explain the process of planning structured cabling for horizontal and backbone cabling 1. Select horizontal and backbone cabling 2. Identify electricity and grounding issues 3. Identify cabling and grounding issues 4. Apply design principles in workplace situations B. Identify network power supply issues 1. Identify power line problems 2. Explain surge suppressors and uninterruptible power source (UPS) functions C. Demonstrate basic understanding of network design and documentation issues 1. Explain some of the issues of network design 2. Explain how to start designing a network 3. Explain a general network design process 4. Give an overview of wiring closet selection, selection of the main distribution facility (MDF) and intermediate distribution facility (IDF) and power supply issues	4			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
X. STRUCTURED CABLING PROJECT A. Explain how to plan the project 1. Describe network installation safety procedures 2. Describe network documentation, both planning and as-built documents B. Demonstrate RJ-45 jack and outlet installation 1. Identify EIA-TIA 568-B standards 2. Describe a jack (as specified by EIA/TIA 568-B) for a telecommunications outlet 3. Explain how to mount an RJ-45 jack 4. Explain how to surface-mount an RJ-45 jack 5. Describe some of the advantages of surface-mounting an Rj-45 jack 6. List some factors to consider before flush-mounting an RJ-45 jack 7. Explain how to flush-mount a jack in drywall 8. Explain how to flush-mount a jack in plaster 9. Explain how to flush-mount a jack in wood 10. Explain how to flush-mount a jack in a wall 11. Describe the procedure for placing the copper wires of the cable into the jack 12. Describe the procedure for punching the wires down into the jack 13. Demonstrate RJ-45 jack and outlet installation C. Demonstrate a basic understanding of cable installation 1. Describe the basics of installing UTP cable D. Demonstrate a basic understanding of wiring closets and patch panels 1. Define wiring closet 2. Describe where the horizontal cabling runs are connected in the wiring closet 3. Describe the structure of a patch panel 4. Describe how the wires are laid down on a patch panel 5. Describe how wires are punched down on a patch panel 6. Describe how to mount a patch panel	12			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
E. Identify the range of equipment for testing structured cabling projects 1. Describe the procedure for testing cable that has already been installed 2. Explain how you would know that a network is operating correctly 3. Describe any special equipment or training needed to test cable 4. Identify the function of cable testers and explain what they measure 5. Explain how a cable tester measures distance 6. Explain how to use distance measurements to determine whether there are good connections at patch panels and telecommunications outlets 7. Explain how a cable tester can detect whether an installer has connected wires in reverse order to a plug or jack 8. Explain why a wire map will not detect split pairs 9. Describe how a cable tester measures signal attenuation 10. Describe causes of near-end cross talk 11. Describe the types of problems that a noise level test can detect 12. Explain how a cable tester can locate sources of outside interference 13. Demonstrate cable testing procedures				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
XI. LAYER 3: ROUTING AND ADDRESSING A. Explain why it is necessary to have a network layer 1. Explain why identifiers (names) are not enough for full connectivity 2. Identify the needs for multiple networks: segmentation and autonomous systems 3. Explain why there is a need for communication between separate networks 4. Illustrate network-to-network connection of Layer 3 devices and other devices B. Explain path determination 1. Define path determination 2. Describe addressing as a function of the network layer and as a way to achieve routing 3. Explain the importance of the Layer 3 function that enables computer mobility 4. Compare and contrast flat and hierarchical addressing C. Explain the purpose and operation of Internet protocol (IP) addresses within the IP header 1. Diagram the network layer datagram 2. Describe the fields in the network layer 3. Identify the source and destination fields in an IP header and explain their purposes 4. Define an IP address as a 32-bit binary number 5. Identify the component fields of an IP address D. Explain and work with IP address classes 1. Identify classes of IP addresses 2. Explain why binary IP addresses appear as decimal numbers 3. Review binary-to-decimal and decimal-to-binary conversions 4. Convert decimal IP addresses to their binary equivalents 5. Convert binary IP addresses to their decimal equivalents E. Explain the purpose of reserved address space 1. Explain the existence of network ID and broadcast address 2. Identify network ID 3. Compare network Ids to zip codes 4. Identify broadcast address 5. Compare and contrast broadcast addresses to bulk mailings 6. Explain the number of hosts that are on different classes of IP addresses	9			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
F. Demonstrate a basic understanding of subnetting 1. Explain why classical IP addressing is inefficient 2. Define subnetwork 3. Identify one reason for using subnetwork 4. Define subnet mask 5. Perform the Boolean operations AND, OR, and NOT 6. Perform the AND function, as a router would, to obtain the network number, given the complete IP address and subnet mask G. Explain how to create a subnet 1. Identify the range of bits that can be borrowed to create 2. Explain how the subnet mask determines the size of the subnetwork 3. Compute the number of subnets, given a subnet mask and IP address 4. Compute the number of hosts per subnetwork, given a subnet mask and IP address 5. Perform a Boolean AND operation to compute a network number 6. Illustrate an IP configuration on a network diagram 7. Optimize host/subnet schemes 8. Explain private addresses (IP v. 6)				
XII. LAYER 3: ROUTING PROTOCOLS A. Identify the characteristics of Layer 3 devices 1. Define the term “router” and explain why it is a Layer 3 device 2. Explain that routing uses Layer 3, not Layer 2, addresses 3. Describe the purpose of a router 4. Explain that each router interface attaches to a unique network B. Explain how network layer services are used to achieve network-to-network communications 1. Describe how an end station can obtain an IP address 2. Describe the dynamic host configuration protocol (DHCP) initialization sequence 3. Identify the key components of IP 4. Describe the function of the address resolution protocol (ARP) 5. Describe ARP operation within a subnet	4			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
C. Demonstrate an understanding of advanced ARP concepts 1. Describe a default gateway 2. Identify two problems associated with sending data to nodes on different subnets 3. Explain how ARP sends data to remote networks 4. Describe the operation of proxy ARP 5. Draw a flowchart of four important Layer 3 processes D. Explain routable protocols 1. Define routed protocol 2. Name three routed protocols 3. Name some routable and nonroutable protocols 4. Describe the characteristics of a routable protocol E. Explain routing protocols 1. Explain that routers use routing protocols to communicate network information to each other 2. Define routing protocol 3. Describe the sequence of encapsulation during routing 4. Describe multiprotocol routing F. Explain the function of other network layer services in Internet communication 1. Describe connectionless network services 2. Describe connection-oriented network services 3. Contrast connectionless and connection-oriented network processes 4. Identify IP as a connectionless network service G. Interpret ARP tables 1. Describe which internetworking devices have ARP tables 2. Explain how router ARP tables differ from ARP tables kept by other networking devices 3. Describe the other addresses that are contained in router tables 4. Describe what happens when a device does not know the MAC address of the router to be used in performing indirect routing services 5. Explain what occurs when a subnetwork device does not know the destination MAC address of a device on another subnetwork 6. Explain when a device would need to search for a router				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
H. Demonstrate understanding of routing information protocol (RIP) and interior gateway routing protocol (IGRP) 1. Describe the difference between routed protocols and routing protocols 2. Describe the difference between interior gateway protocols (IGPs) and exterior gateway protocols (EGPs) 3. Define RIP and explain how it works 4. Define IGRP and exterior gateway routing protocol (EGRP) 5. Define open shortest path first (OSPF) 6. Explain how routers recognize networks 7. Describe examples of static routing 8. Describe an example of dynamic routing 9. Explain how routers would use RIP to route data through a network I. Demonstrate understanding of protocol analyzer software 1. Explain function of protocol analyzer software 2. Use protocol analyzer software				
XIII. LAYER 4: THE TRANSPORT LAYER A. Demonstrate understanding of Layer 4, the transport layer 1. Explain the purpose of Layer 4 2. Use analogies to explain Layer 4 functions 3. Describe the general form of Layer 4 protocols 4. Compare and contrasst transmission control protocol (TCP) and IP B. Demonstrate understanding of TCP and UDP 1. Describe the general form of TCP 2. Describe TCP segment format 3. Describe the general form of UDP 4. Describe UDP segment format C. Identify TCP connection methods 1. Explain port numbers 2. Describe a three-way handshake/open connection 3. Describe simple acknowledgment 4. Describe sliding windows 5. Explain sequence and acknowledgement numbers	4			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
XIV. LAYER 5: THE SESSION LAYER A. Give an overview of the session layer B. Explain the session layer in simple terms of analogies (like dialogues) C. Understand the process of dialogue control and dialogue separation, including both major and minor synchronization D. Recognize the following layer 5 protocols: NFS, SQL, RPS, X-Window, ASP, SCP	4			
XV. LAYER 6: THE PRESENTATION LAYER A. Demonstrate a basic understanding of the presentation layer 1. Explain the presentation layer in simple terms 2. Give an overview of the presentation layer 3. Recognize data format 4. Describe file formats 5. Describe graphics formats 6. Describe multimedia formats 7. Describe markup language formats 8. Explain data encryption 9. Describe data compression	4			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
XVI. LAYER 7: THE APPLICATION LAYER A. Demonstrate understanding of client-server applications 1. Explain the client-server illustration, "downloading files" 2. Explain the meaning of a client-server Web request response 3. Describe client-server file storage and client-server print operation 4. Describe the process of making and breaking a connection B. Demonstrate understanding of domain name services 1. Explain IP address packet transfer/with IP tables 2. Interpret domain naming system (DNS) tables 3. Describe a network DNS server 4. Describe the DNS lookup sequence C. Identify various network and Internet applications D. Explain e-mail as an application layer example 1. Explain the post office analogy for e-mail 2. Describe the format of an e-mail message 3. Describe the function of a DNS 4. Relate e-mail to servers 5. Discuss e-mail security 6. Relate e-mail to encapsulation and the OSI model 7. Discuss mail server functions 8. Describe file formats associated with e-mail E. Explain Telnet as an application layer example 1. Describe the purpose of Telnet 2. Explain how Telnet works F. Explain file transfer protocol (FTP) as an application layer example 1. Explain the purpose of FTP 2. Describe how FTP works G. Explain hypertext transfer protocol (HTTP) as an application layer example 1. Explain the purpose of HTTP 2. Describe hyperlinks 3. describe a uniform resource locator (URL) 4. Describe the process of Web page transfer H. Explain redirectors as an application layer example 1. Define redirector 2. Describe how a redirector works I. Demonstrate a basic understanding of the application layer 1. Explain the purpose of the application layer 2. Compare a Web browser to a TV remote control	4	Info Tech; Info Tech; IV.m	ELA 9-10; W; 2.6 LS; 1.1; 1.3-1.8 ELA 11-12; W; 1.3, 1.5-1.8 A1 13.0, 24.0, 25.0	**M. 7; NS; 1.1-1.3, 2.1-2.3 AF; 1.1, 1.2, 1.5, 4.1, 4.2 MR 1.1, .12, 2.1, 2.4, 2.4, 3.1, 3.3** **A1 – 5.0, 10.0, 15.0**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
CISCO 2 XVII. NETWORKING REVIEW A. Demonstrate understanding of a wide variety of network users' needs and demands B. Define protocol and its importance in networking 1. Describe the process of communication between the seven layers 2. Describe protocol data units and data encapsulation 3. Define and describe bits, frames, packets, and segments	2			
XVIII.OSI MODEL A. Demonstrate an understanding of the OSI Model standards and the function of the 7 layers 1. Application layer and the application of those functions at the computer network or inter network layers 2. Presentation layer and the various standards applied to the presentation layer 3. Session layer and the protocols/interfaces appropriate to the layer 4. Transport layer, including each of the following: a. Segments b. Establishing connections c. Flow control d. Data transfer e. Windowing f. Error recovery g. Acknowledgment B. Demonstrate an understanding of the data link sublayers by identifying and defining the following: 1. Data logical link control (LLC) 2. Service access points (saps) 3. Physical layer 4. Data link layer C. Demonstrate an understanding of LAN technologies 1. Ethernet/IEEE standard 802.3 as applied to physical layer topology 2. Interface (AUI) 3. Broadcast 4. Multicast 5. Unicast 6. Operation 7. Termination	12	Info Tech; Info Tech; IV.m	ELA 9-10; W; 2.6 LS; 1.1; 1.3-1.8 ELA 11-12; W; 1.3, 1.5-1.8 A1 13.0, 24.0, 25.0	**M. 7; NS; 1.1-1.3, 2.1-2.3 AF; 1.1, 1.2, 1.5, 4.1, 4.2 MR 1.1, .12, 2.1, 2.4, 2.4, 3.1, 3.3** **A1 – 5.0, 10.0, 15.0**

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
D. Demonstrate an understanding of the Ethernet frames, including the following: 1. Describe a preamble 2. Identify and locate destination/source physical address 4. Describe the criteria for judging the contents of the following: a. Type b. Data c. Frame check sequence field E. Demonstrate an understanding of addressing schemes, including the following: 1. MAC address function and construction 2. ARP function and process F. Demonstrate an understanding of Ethernet reliability 1. Name and identify network standards applicable to Ethernet reliability 2. define and describe the concept of reliability 3. Identify and describe CSMA/CD applicability to reliability 4. Define and describe use of timers G. Demonstrate an understanding of the evolution of Ethernet options 1. Define and describe token-ring topology 2. Define and describe a token-ring physical layer 3. Identify and describe a token-ring interface 4. Describe token-ring operation 5. Describe token-ring frame\ 6. Discuss access control field 7. Describe and identify a priority field 8. Describe and identify a reservation field 9. Define and discuss active monitor				
H. Apply previously learned understandings of routers, fiber optic cables, and ring topology to LAN technologies of Ethernet and token-ring topologies I. Demonstrate an understanding of network reliability 1. Define and describe frame status field – A bit 2. Describe and define copied – C bit				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
J. Define and demonstrate an understanding of the concepts of FDDI 1. Describe the physical layer topology process used by a router 2. Describe the process of using a dual attachment stat (DAS) 3. Describe and apply a single attachment stat (SAS) 4. Describe FDDI interface 5. Define and describe FDDI operation K. Describe and demonstrate the reliability of using FDDI to monitor all stations L. Demonstrate an understanding of how reliability and FDDI identify a failure domain M. Demonstrate an understanding of the application of WAN standards to the following: 1. Physical layer 2. Data terminal equipment 3. Data circuit – terminating equipment 4. Data link layer/encapsulation 5. Path determination 6. Network layering N. Given a statement of network needs, identify and evaluate the routing protocols based on those needs				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
XIX. PROTOCOL NETWORK ADDRESSING A. Define and describe the purposes of other protocol network addressing 1. Describe the role of the network administrator 2. Discuss the relationship between addressing and routing B. Demonstrate an understanding of routes 1. Define, describe, or illustrate a static route 2. Describe or illustrate dynamic route 3. Describe the purpose of routed protocols 4. Define, describe, and write a routing protocol 5. Define and describe the purpose and function of multiprotocol routing 6. Describe and illustrate the process and function of reliability in routing IP addresses C. Apply metric values to routing 1. Identify and describe a metric value 2. Describe dynamic routing 3. Describe hybrid routing 4. Describe and illustrate integrated routing 5. Compare and apply previously learned content to the following: a. Static routes b. Dynamic routes c. Path selection D. Demonstrate an understanding of TCP/IP network layer addressing 1. Describe and do a TCP/IP network layer address 2. Describe and illustrate a host address 3. Describe the process used to identify an A, B, C, and D class 4. Apply network protocols to an identified problem	6			
XX. ROUTING SCHEMES A. Demonstrate an understanding of dynamic routing B. Define and describe the function of distance vectors C. Define and describe distance vector convergence D. Demonstrate an understanding of the concept of time to convergence 1. Define and describe update topology changes 2. Define and describe routing loops 3. Define and describe the function of each of the following convergence processes: a. Counting to infinity b. Defining a maximum c. Split horizon d. Route poisoning e. Holddown timers	18			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
E. Define and describe the function of a link state 1. Describe and conduct a network discovery 2. Describe the purpose of link state packets 3. Define the functions of a shortest path first application 4. Conduct an *open shortest path first* (OSPF) F. Define and describe the process of updating topology changes G. Define and demonstrate an understanding of link state updates H. Demonstrate an understanding of the processes used for the following: 1. Synchronizing large networks 2. Router start-up 3. Partitioning regions 4. Applying link state mechanisms 5. Frequency of updates 6. Multicast updates 7. Hierarchies I. Demonstrate an understanding of the importance, use, and selection of media 1. define the va4rious types of media 2. Describe the various purposes of each type of media 3. Describe the advantages and disadvantages of each type of media J. Demonstrate an understanding of the problems and solutions associated with LAN-to-LAN routing K. Identify, analyze, and apply solutions to EMI and RFI problems using cancellation and shielding L. Demonstrate an understanding of the factors involved in selecting the appropriate user interfaces by discussing advantages and disadvantages of the following: 1. User mode 2. User password 3. User mode command list 4. Log-in router 5. Privileged mode 6. Enabling password 7. Privilege mode command list 8. Exec commands 9. Context-sensitive help 10. Editing commands 11. Reviewing command history				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
M. Apply various standards to the selection of external configuration sources 1. Identify, describe the function of, and determine the standard appropriate to selecting each of the following terminals: a. Console terminal b. Modem through auxiliary port c. Virtual terminals 2. Identify, describe the function of, and determine the standard appropriate to making decisions about the following internal configuration components: a. RAM/DRAM b. NVRAM c. Flash d. Rom e. Interfaces 3. Identify, describe the function of, and determine the appropriate use of each of the following router modes: a. User EXEC mode b. Privileged ESEC mode c. Setup mode d. Global configuration mode e. Rxboot mode f. Router status commands N. Apply understanding of network protocols to other (non-Cisco) routers				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
XXI. NETWORK ARCHITECTURE A. Demonstrate an understanding of network architecture by identifying the function and appropriate use of the following: 1. Cisco discovery protocol (CDP) 2. CDP neighbors 3. Telnet B. Demonstrate an understanding of the processes used in the testing of a network 1. Describe the various processes used to determine when to test and the purposes 2. Design and conduct a test of a network layer a. Select the appropriate ping command b. Select the appropriate trace command c. Show the appropriate IP route command C. Demonstrate an understanding of LAN design by testing a network in the laboratory through the following: 1. Apply the process for gaining remote access to a router 2. Apply the process for using CDP and analyze the information gained from CDP 3. Apply the process to Telnet 4. Apply the process to test each of the following layers: a. Application b. Network c. Data link d. Physical 5. Evaluate what worked and what did not 6. Apply solutions as appropriate D. Demonstrate an understanding of the concepts of testing data link/physical layers E. Define, describe, and recognize the following: 1. Carrier detect message 2. Keepalive message 3. Show interface serial command 4. Debug command 5. Logging message	12			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
F. Describe the purpose and function of setup 1. Describe the process of system setup 2. Write the startup sequence correctly; using setup mode, identify and describe the following: a. Password/security b. Global parameters c. Interface parapmeters 3. Describe and apply the process of system setup 4. Describe and apply the process of system startup 5. State the advantages and disadvantages of system startup and system setup				
XXII. ROUTER CONFIGURATION FILES A. Define and describe router configuration files 1. Describe the use of a remote terminal console 2. State the advantages and disadvantages of using a network trivial file transfer protocol (TFTP) server 3. State or list the standards for NVRAM applications B. Describe the process for configuring from TFTP server 1. Identify and describe the process fro configuring from NVRAM 2. State the sequence used in startup mode 3. Describe the process used in setup mode 4. Describe the process for each of the following: a. User EXEC mode b. Global configure mode c. IP routing protocol mode d. Interface configure mode C. Demonstrate an understanding of configuration methods through the following: 1. Apply privileged EXEC mode to manage configuration files 2. Apply configuration methods to control router passwords and router identification D. Demonstrate an understanding of TFTP server control 1. Identify and describe the process for locating Cisco IOS software 2. Describe the process for and perform NVRAM-default source 3. State the advantages and disadvantages of boot field settings	15			

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
4. Describe the process for locating commands information software on router 5. State the advantages and disadvantages of using bootstrap options to locate flash memory, network server, and ROM 6. Describe the process for preparing TFTP sserver for the following: a. Showing flash commands b. Naming conventions 7. Describe the process for creating image software backup 8. Describe the process for upgrading the image from NET 9. Describe the process for loading image software backup E. Apply commands to locate Cisco IOS software F. Apply the process for backing up and upgrading software image G. Identify and describe the use and function of TCP/IP, and define and identify the following: 1. Application layer protocols 2. TCP/IP functions 3. Transport layer protocols H. Define and describe TCP 1. Segment 2. Port numbers 3. Acknowledgments 4. Sliding window I. Demonstrate an understanding of UDC 1. Define and describe UDC segment 2. Define and describe network layer J. Demonstrate an understanding of the process for IP 1. Identify and describe datagram Describe protocol field 3. Describe the role of ARP and RARP in IP K. Describe the process for identifying a subnet mask: 1. Without subnets 2. With subnets L. Describe IP addresses, including the following: 1. IP classes 2. IP bit patterns 3. IP host addresses with subnets 4. IP addresses without subnets				

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Core Academic Standard	CAHSEE
M. Describe and write decimal equivalents of bit patterns N. Demonstrate an understanding of the process for subnet planning O. Identify, describe, and locate a broadcast address 1. Directed 2. Flooding P. Demonstrate an understanding of the process for configuring IP addresses, using the following: 1. Host names 2. Server configuration name 3. System name 4. IP addressing verification of the following: a. Telnet b. Ping simple c. Ping extended d. Trace Q. Apply previously learned concepts to configure IP addresses R. Demonstrate an understanding of IP by taking the following steps: 1. Verify IP addresses 2. Complete an initial router configuration 3. Use IP routing protocol to create an internetwork with RIP and IGRP				
XXIII. ACCESS CONTROL LISTS A. Define and describe the purpose and operation of the following: 1. Standard access lists 2. Extended access lists B. Create a list of deny/permit tests; explain the difference. C. Define and explain the function and operation of wildcard masks bits. D. Create an access list that illustrates configuration Commands, including global statements and interface commands. E. Summarize how to identify access lists. F. Explain and conduct the processes involved for testing packs with access lists. G. Create an IP access list by using the following: 1. Wildcard mask bits 2. Wildcard any 3. Wildcard host H. Configure IP with standard access. I. Configure extending IP with access lists by using named IP access list. J. Document location of IP access list.	20			

10. Additional recommended/optional items
    a. Articulation: None
    b. Academic credit: None
    c. Instructional strategies:
        Methods of Instruction:
            a. Lecture
            b. Audio Visual Materials
            c. Research Readings and Written Presentations
            d. Homework Assignments
            e. Group & Individual Activities
            f. Discussion & Group Dynamics
            g. Quizzes, Tests & Final Exam
            h. Guest Speakers
            i. Internet Exploration
    d. Instructional materials:
    e. Certificates: Certified Cisco Network Associate