COLTON REDLANDS YUCAIPA
REGIONAL OCCUPATIONAL PROGRAM
Inspiring Possibilities

2017-2018

CISCO Internetworking, Level 1

OUTLINE

DESCRIPTION:

This program uses industry based curriculum developed by the CISCO Corporation and is designed to prepare students for employment as computer network designers, installers, and network maintenance and technology support technicians. Students exiting the program may take certification tests through the CISCO Certified Internetworking Association.

In Level 1, students learn the fundamentals of networks, network devices, Internet protocol (IP) addressing, address resolution protocol (ARP/RARP), media & design, topology, structured cabling, and electronics. Students will complete lab activities that reinforce basic networking fundamentals. Activities in this course include work-based learning that connects students to industry and the local community.
CISCO Internetworking, Level I has been UC a-g approved to meet the elective ("g" – Mathematics – Computer Science) requirement.

INFORMATION:

A. Pre-requisite: None
B. Length: One semester
C. Sector: Information and Communication Technologies
D. Pathway: Networking

O*Net SOC Codes	
Code #	**Title**
15-1142.00	Network and Computer Systems Administrators
15-1151.00	Computer User Support Specialists
15-1152.00	Computer Network Support Specialist

Orientation

A. Introduce the course and facilities.
B. Discuss the syllabus and major objectives.
C. Explain applicable classroom management procedures, the ROP Student Rules of Conduct, and any operational guidelines.
D. Review instructor/student expectations.
E. Explain enrollment and attendance requirements and procedures.
F. Review grading and student evaluation procedures.
G. Discuss the community classroom aspect of the program if applicable.
H. Discuss the "next steps" related to additional education, training, and employment.
I. Review classroom safety, emergency and disaster procedures.

1. Communication Skills

A. Demonstrate positive verbal communication skills using appropriate vocabulary, demeanor, and vocal tone in the classroom and/or worksite.
B. Read and interpret written information and directions.
C. Practice various forms of written communication appropriate to the occupation.
D. Practice positive body language skills.
E. Practice professional verbal skills for resolving a conflict.
F. Demonstrate active listening skills including techniques for checking for understanding, and for obtaining clarification of directions.

2. Interpersonal Skills

A. Demonstrate positive teamwork skills by contributing to a group effort.
B. Practice the importance of diversity awareness and sensitivity in the workplace.
C. Define sexual harassment in the workplace and identify the employee's role and responsibility.
D. Practice participation skills.
E. Identify different personality types and strategies for working effectively with each type.
F. Practice business and social etiquette skills appropriate to the occupation.
G. Discuss the role of business and personal ethics in the decision-making process.
H. Evaluate various job-related scenarios and justify decisions based on ethics.
I. Demonstrate flexibility and adaptability in working with others.
J. Demonstrate the use of time management skills.

3. Personal and Occupational Safety

Includes updates from 16/17 Advisory meeting

A. Demonstrate procedures to be followed in the case of emergencies.
B. Discuss ways to report a potential safety hazard to a supervisor.
C. Identify and discuss cyber ethics, cyber safety, and cyber security.
D. Apply personal safety practices to and from the job.
E. Describe the procedure for reporting a work-related hazard or injury.
F. Recognize the effects of substance abuse in the workplace.
G. Recognize good housekeeping as a safety issue.
H. Identify safety hazards commonly found in the workplace environment.
I. Describe the procedures for reporting a work-related injury.
J. Explain the importance of CAL-OSHA.
K. Define and discuss ergonomics in relation to the working environment.
L. Discuss the electrical hazards of working with electronic equipment.

4. Leadership

A. Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
B. Work with peers to promote divergent and creative perspectives.
C. Demonstrate how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.
D. Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
E. Employ ethical behaviors and actions that positively influence others.
F. Use a variety of means to positively impact the direction and actions of a team or organization.
G. Analyze the short-term and long-term effects a leader's actions and attitudes can have on productivity, morale, and organizational culture.

5. Connecting to the Internet 1.1

A. Demonstrate correct procedures for use of web browsers and plug-ins as a resource for information and trouble-shooting.
B. Describe how applications and protocols work to interrupt and display information and to send and receive data across the Internet.
C. Install and troubleshoot network interface cards and/or modems.
D. Use basic testing procedures to test the Internet connection.
E. Identify and describe physical and logical connections required for a computer to connect to the Internet.
F. Recognize and name the major components of a PC.

6. Network Math Overview 1.2

A. Describe binary and decimal representation of IP addresses and network masks.
B. Describe binary presentation of data.
C. Describe bits and bytes as represented in data.

D. Identify the base 10, base 2, and hexadecimal number systems.
E. Convert decimal numbers to 8-bit binary numbers, and 8-bit binary numbers to decimal numbers.
F. Describe four-octet dotted decimal representation of 32-bit binary numbers.
G. Describe Boolean logic.

7. Networking Terminology 2.1

A. Describe the history of networking.
B. Identify network devices.
C. Describe data networks and network topologies.
D. Describe the role of protocols in networking.
E. Define LAN, WAN, MAN, and SAN.
F. Describe and list the benefits of Virtual Private Networks (VPNs).
G. Describe the difference between intranets and extranets.

8. Bandwidth 2.2

A. Describe the importance of bandwidth.
B. Explain the difference between bandwidth and throughput.
C. Describe the limitations of bandwidth and throughput.
D. Identify bps, kbps, Mbps, and Gbps as units of bandwidth.
E. Calculate data transfer rates.
F. Describe digital versus analog.

9. Networking Models 2.3

A. Describe the development of the OSI model.
B. Explain why layered models are used to describe data communication.
C. Identify the seven layers of the OSI model.
D. Identify the four layers of the TCP/IP model.
E. Describe the data encapsulation process.

10. Copper Media 3.1

A. Construct straight-through, crossover, and rollover cables and state where each is used.
B. Describe the electrical properties of matter.
C. Define voltage, resistance, impedance, current, and circuits.

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D. Describe the specifications and performances of different types of cable.
E. Describe coaxial cable and its advantages and disadvantages over other types of cable.
F. Describe shielded twisted-pair (STP) cable and its uses.
G. Describe unshielded twisted-pair (UTP) cable and its uses.

11. Optical Media 3.2

A. Explain the basics of fiber-optic cable.
B. Describe how fibers can guide light for long distances.
C. Describe multimode and single-mode fiber.
D. Describe how fiber is installed.
E. Describe the type of connectors and equipment used with fiber-optic cable.
F. Explain how fiber is tested.
G. Describe the safety issues of installation, care and testing of optical fiber.

12. Wireless Media 3.3

A. Describe the wireless LAN organizations and standards.
B. Identify wireless devices and topologies.
C. Describe how wireless LANs communicate.
D. Describe the authentication and association processes.
E. Describe the radio wave and microwave spectrums.
F. Identify signals and noise on a WLAN.
G. Describe security issues on WLAN.

13. Background for Studying Frequency Based Cable Testing 4.1

A. Identify waves.
B. Describe the difference between sine waves and square waves.
C. Define and calculate exponents and logarithms.
D. Define and calculate decibels.
E. Describe basic terminology related to time, frequency, and noise.
F. Describe the difference between digital bandwidth and analog bandwidth.
G. Compare and contrast noise levels on various types of cabling.

14. Signals and noise 4.2

A. Describe signaling over copper and fiber optic cabling.
B. Define and describe the affects of attenuation and impedance mismatch.
C. Describe sources of noise on copper media.
D. Define crosstalk, near-end crosstalk, far-end crosstalk, and power sum near-end crosstalk.
E. Describe the ten copper cable tests defined in TIA/EIA-568-B.
F. Describe time-based parameters.
G. Describe fiber-optic testing.
H. Describe the difference between Category 5 and Category 6 cable.

15. Cabling the LAN 5.1

A. Describe the function, advantages, and disadvantages of repeaters, hubs, bridges, switches, and wireless network components.
B. Describe the function of peer-to-peer networks.
C. Describe the function, advantages, and disadvantages of client-server networks.
D. Identify characteristics of Ethernet networks.
E. Identify Ethernet media and connector requirements.

16. Cabling the WAN 5.2

A. Describe and differentiate between serial, Integrated Service Digital Network (ISDN), digital subscriber line (DSL), and cable modem WAN connections.
B. Identify router serial ports, cables, and connectors.
C. Identify and describe the placement of equipment used in various WAN configurations.
D. Set up console connections.

17. Ethernet Fundamentals 6.1

A. Describe Ethernet technology.
B. Describe the IEEE naming rules of Ethernet technology.
C. Define how Ethernet and the OSI model interact.
D. Describe the Ethernet framing process and frame structure.
E. List Ethernet frame field names and purposes.

18. Ethernet Operation 6.2
A. Identify the characteristics of CSMA/CD. B. Describe the key aspects of Ethernet timing, Inter-frame spacing and back-off time after a collision. C. Describe and define Ethernet errors and collisions. D. Describe auto-negotiation in relation to speed and duplex. E. Define FCS.
19. 10-Mbps and 100-Mbps Ethernet 7.1
A. Compare and contrast 10BASE5, 10BASE2, and 10BASE-T Ethernet. B. Define Manchester encoding. C. Describe the factors that affect Ethernet timing limits. D. Describe 10BASE-T wiring parameters. E. Describe the key characteristics and varieties of 100-Mbps Ethernet. F. Describe the evolution of Ethernet.
20. Gigabit and 10-Gigabit Ethernet 7.2
A. Describe the MAC methods, frame formats, and transmission process of Gigabit Ethernet. B. Describe the uses of specific media and encoding with Gigabit Ethernet. C. Identify the pin-outs and wiring typical to the various implementations of Gigabit Ethernet. D. Compare and contrast Gigabit and 10 Gigabit Ethernet. E. Describe the basic architectural considerations of Gigabit and 10 Gigabit Ethernet.
21. Ethernet Switching 8.1
A. Define and describe bridging and switching. B. Define and describe the content-addressable memory (CAM) table. C. Define latency. D. Describe store-and-forward and cut-through switching modes. E. Describe Spanning-Tree Protocol (STP).

22. Collision Domains and Broadcast Domains 8.2

A. Describe network segmentation and list the devices used to create segments.
B. Define collisions, broadcasts, collision domains and broadcast domains.
C. Identify the Layer, 1, 2, and 3 devices used to create collision domains and broadcast domains.
D. Describe data flow and problems with broadcasts.

23. Introduction to TCP/IP 9.1

A. Describe the development of the Internet and how TCP/IP fits the design of the Internet.
B. Define and describe each of the four layers of the TCP/IP model.
C. Compare and contrast the OSI model and the TCP/IP model.

24. Internet Addresses 9.2

A. Describe the function and structure of IP addresses.
B. Describe why sub-netting is necessary.
C. Define Class A, B, C, D, and E IP addresses.
D. Describe the differences between public and private addressing.
E. Describe the function of reserved IP addresses.

25. Obtaining an IP Address 9.3

A. Describe the process of obtaining an Internet address.
B. Describe the use of static and dynamic addressing for a device.
C. Describe how dynamic addressing can be done using RARP, Boot-P, and DHCP.
D. Use ARP to obtain the MAC address to send a packet to another device.
E. Define and describe the issues related to addressing between networks.
F. Define Address Resolution Protocol (ARP).

26. Routed Protocol 10.1

A. Describe routable and routed protocols.
B. Define IP as a routed protocol.
C. List the steps of data encapsulation in an internetwork as data is routed to one or more Layer 3 devices.
D. Describe connectionless and connection-oriented delivery.

E. Define and describe the IP packet fields.

27. IP Routing Protocols 10.2

A. Describe the process of routing.
B. Describe the difference between routing and switching.
C. Compare and contrast different types of routing protocols.
D. Describe path determination.
E. List and describe several metrics used by routing protocol.
F. Describe IGP and EGP.
G. Describe link state and distance vector.

28. The Mechanics of Sub-netting 10.3

A. Describe several uses for sub-netting.
B. Determine the subnet mask for a given situation.
C. Use a subnet mask to determine the subnet ID.
D. Calculate a resident sub-network through ANDing.

29. TCP/IP Transport Layer 11.1

A. Describe several uses for sub-netting.
B. Determine the subnet mask for a given situation.
C. Use a subnet mask to determine the subnet ID.
D. Calculate a resident sub-network through ANDing.

30. The Application Layer 11.2

A. Define the major protocols of the TCP/IP application layer and their uses.
B. Describe the features and operations of DNS, FTP, HTTP, SMTP, SNMP, and Telnet.

31. Structured Case Study

A. Complete a structured cabling case study on paper.
B. Complete an installation project.

Key Assignments

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
1. Students will evaluate a variety of computer components, troubleshoot, and build a functioning computer.	1A,C,F 2A,D,G 3A,B,E 5A,F 7B 10A,D-G 13A-G 14A	1 5 11	4 5 6 10	Information Support Service A6.0 A7.0 Engineering Technology B3.0	CC 2,4 ETS 1B LS 11-12.3 PS 4C RSTS 11-12.4 SEP 1 SEP 8 WS 11-12.6 WS11-12.7
2. Students will analyze multiple network connectivity issues and resolve issues to transfer data across network.	1A,B 2A,D,F,J 5A-E 6A,C-G 7C,D,E,G 8A-F 9D,E 10A-G 11A-G 14B-H 15A-E 16A-D 17A-E 18A-E 19A-F 20A-E 21A-E 22A-D 23A-C	1 4 5 11	4 5 6 10 11	Networking Pathway B1.0 B2.0 B3.0 B4.0 B5.0 B6.0 B7.0 B8.0	LS 11-12.6 RSTS 11-12.4 WS11-12.6 WS11-12.7

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Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
	24A-E 25A-E 27A-G 28A-D 29A-D				
3. Students will design a physical and logical network to customer needs.	1A,C,F 2A 5D-F 6A-G 7B-G 8A-E 9A-E 10A-G 11A-G 12A-G 13A,C,E,G 14A-H 15A-E 16A-D 17A-E 18A-E 19A-F 20A-E 21A-E 22A-D 23A-C 24A-E 25A-F	1 2 4 5 11	2 4 5 7 10 11	Networking Pathway B1.0 B2.0 B3.0 B4.0 B5.0 B6.0 B7.0 B8.0	LS 11-12.6 SLS 11-12.1 WS 11-12.6 WS 11-12.7

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
	26A-E 27A-G 28A-D 29A-D 30A-B 31A-B				

Standards Assessed in this Program

Career Ready Practices

1. **Apply appropriate technical skills and academic knowledge.**
2. **Communicate clearly, effectively, and with reason.**
3. **Develop an education and career plan aligned to personal goals.**
4. **Apply technology to enhance productivity.**
5. **Utilize critical thinking to make sense of problems and persevere in solving them.**
6. **Practice personal health and understand financial well-being.**
7. **Act as a responsible citizen in the workplace and the community.**
8. **Model integrity, ethical leadership, and effective management.**
9. **Work productively in teams while integrating cultural/global competence.**
10. **Demonstrate creativity and innovation.**
11. **Employ valid and reliable research strategies.**
12. **Understand the environmental, social, and economic impacts of decisions.**

Anchor Standards

2.0 Communications

- Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

- Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

- Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the sector workplace environment.

5.0 Problem Solving and Critical Thinking

- Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

- Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.

7.0 Responsibility and Flexibility

- Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

- Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

- Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.

10.0 Technical Knowledge and Skills

- Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.

Pathway Standards

Engineering and Architecture – Engineering Technology Pathway

B3.0 Identify the fundamentals of the theory, measurement, control, and applications of electrical energy, including alternating and direct currents.

Information and Communication Technologies- Information Support and Services Pathway

A6.0 Diagnose and solve software, hardware, networking, and security problems.
A7.0 Support and train users on various software, hardware, and network systems.

Information and Communication Technologies- Networking Pathway

B1.0 Identify and describe the principles of networking and the technologies, models, and protocols used in a network.
B2.0 Identify, describe, and implement network media and physical topologies.
B3.0 Install, configure, and differentiate between common network devices.
B4.0 Demonstrate proper network administration and management skills.
B5.0 Demonstrate how to communicate and interpret information clearly in industry-standard visual and written formats.
B6.0 Use and assess network communication applications and infrastructure.
B7.0 Analyze a customer's organizational needs and requirements to identify networking needs.
B8.0 Identify security threats to a network and describe general methods to mitigate those threats.

Common Core State Standards

ENGLISH LANGUAGE ARTS

Language Standards

LS 11-12.3 Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style,

and to comprehend more fully when reading or listening.
LS 11-12.6: Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the (career and college) readiness level, demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Reading Standards for Science and Technical Subjects

RSTS 11-12.4: Determine the meaning of symbols, key words, and other domain-specific words and phrases as they are used in a specific scientific or technical context.

Speaking and Listening Standards

SLS 11-12.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others ideas and expressing their own clearly and persuasively.
SLS 11-12.2: Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions, and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
SLS 11-12.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others ideas and expressing their own clearly and persuasively.
SLS 11-12.1d: Respond thoughtfully to diverse perspectives, synthesize comments, claims and evidence made on all sides of an issue, resolve contradictions when possible, and determine what additional information or research is required to deepen the investigation or complete the work.

Writing Standards

WS 11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback including new arguments and information.
WS 11-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

SCIENCE

Scientific and Engineering Practices

SEP 1: Asking questions ([or science) and defining problems (for engineering)
SEP 8: Obtaining, evaluating, and communicating information