

July 2007

**Florida Department of Education
Curriculum Framework**

Program Title: Wireless and IP Communications Technician
Occupational Area: Industrial Education

PSVC
CIP Number: 0615040205
Grade Level: College Credit Certificate
Length: 15 credit hours
SOC Code: 17-3023

- I. **MAJOR CONCEPTS AND CONTENT:** This program is designed to prepare individuals for employment in basic wireless and IP Communications related occupations including: Wireless System Technician, Wireless Network Technician, Telecommunication Technician, Network Support Technician, Network maintenance Technician, Tech support Specialist, Electrical & Electronics Technician, Telecommunications Equipment Installer & Repairer, and Electronics Repairer, Commercial & Industrial Equipment in the electronics industry and/or to provide supplemental training for persons previously or currently employed in these occupations.

This program prepares individuals to design, install, configure, and troubleshoot wireless and IP Telephony networks. Graduates of this technical program will be prepared to enter advanced training and education in specialized IP Communications related fields. The content includes, but is not limited to: RF Fundamentals, Wireless Site Surveying, Wireless Security, Design of Converged and Integrated Services Networks, Fundamentals of Voice over IP, Voice Gateway Protocols, and Introduction to Routing and Switching.

Integrated into this content will be communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting. This technical certificate is part of the A.S./A.A.S. degree in Computer Engineering Technology.

- II. **LABORATORY ACTIVITIES:** Laboratory activities are an integral part of this technical program. Enterprise as well as consumer-end wireless access points and wireless bridges will be used to demonstrate the deployment of wireless networks. Also, Cisco CallManager, and Linux TRIXBOX will be used along with Cisco Voice Gateways and Cisco Switches to build converged, IP Telephony networks. Wireless-Security and Voice-Quality testing tools will also be used in this program.
- III. **SPECIAL NOTE:** SkillsUSA is the appropriate career student organization (CTSO) for providing leadership training and for reinforcing specific vocational skills. Career Student Organizations, when provided, shall be an integral part of the career instructional program, and the activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, FAC.

The cooperative method of instruction may be utilized for this program. Whenever the cooperative method is offered, the following are required for each student: a training plan, signed by the student, teacher, and employer, which includes instructional objectives and a list of on-the-job and in-school learning experiences; a workstation that reflects equipment, skills and tasks that are relevant to the occupation which the student has chosen as a career goal. The student must receive compensation for work performed.

To be transferable statewide between institutions, this program/course must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

When a secondary student with a disability is enrolled in a vocational class for which modifications to the curriculum framework have been made, the particular outcomes and student performance standards that the student must master to earn credit must be specified in the student's Individual Educational Plan (IEP). Additional credits may be earned when outcomes and standards are mastered in accordance with the requirements indicated in subsequent IEPs. The job title for which the student is being trained must be designated in the IEP.

- IV. **FEDERAL AND STATE LEGISLATION** requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Adult students with disabilities must self-identify and request such services. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

V. **INTENDED OUTCOMES:** After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate proficiency in computer systems architecture.
- 02.0 Demonstrate proficiency in communication interfacing.
- 03.0 Demonstrate proficiency in customer relations.
- 04.0 Demonstrate proficiency in computer networking techniques.
- 05.0 Demonstrate proficiency in analysis and design of data communications systems.
- 06.0 Demonstrate appropriate communication skills.
- 07.0 Demonstrate employability skills.

The following are intended outcomes for Wireless and IP Communications Technician for Computer Engineering Technology programs that include a specialization in Wireless and IP Communications Technician:

- 08.0 Demonstrate proficiency in RF Math Calculations.
- 09.0 Demonstrate proficiency in planning and deploying Wireless LANs.
- 10.0 Demonstrate proficiency in Conducting Site Surveying
- 11.0 Demonstrate proficiency in implementing Wireless LAN security.
- 12.0 Demonstrate proficiency in configuring IP Telephony servers.
- 13.0 Demonstrate proficiency in interconnecting network devices.
- 14.0 Demonstrate proficiency in configuring and troubleshooting Voice Gateways.
- 15.0 Demonstrate proficiency in configuring Quality of Service for Integrated Services Networks

Florida Department of Education
STUDENT PERFORMANCE STANDARDS

Program Title: Wireless and IP Communications Technician

01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE--The student will be able to:

- 01.01 Draw and explain systems configurations in block detail.
- 01.02 Interpret computer acronyms.
- 01.03 Identify and define priorities and interrupts at system level.
- 01.04 Define and list direct memory access handling systems.
- 01.05 Define functions of advanced memory techniques (e.g. virtual, pipeline, cache).
- 01.06 Troubleshoot a microcomputer system.

02.0 DEMONSTRATE PROFICIENCY IN COMMUNICATION INTERFACING--The student will be able to:

- 02.01 Identify and define serial and parallel interface standards.
- 02.02 Identify, define and configure sync and async devices.
- 02.03 Demonstrate the use of interface devices.
- 02.04 Identify and define networking levels.
- 02.05 Identify and define protocols.
- 02.06 Troubleshoot and repair network systems.
- 02.07 Identify and define multi-user systems.

03.0 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS--The student will be able to:

- 03.01 Describe effective listening techniques.
- 03.02 Describe techniques for instilling customer confidence.
- 03.03 Describe techniques for keeping the customer informed.
- 03.04 Demonstrate proper follow-up techniques.

04.0 DEMONSTRATE PROFICIENCY IN COMPUTER NETWORKING TECHNIQUES--The student will be able to:

- 04.01 Identify and define computer networking techniques.
- 04.02 Design a system using hardware and software communication protocols.
- 04.03 Apply management techniques for network software.

05.0 DEMONSTRATE PROFICIENCY IN ANALYSIS AND DESIGN OF DATA COMMUNICATIONS SYSTEMS--The student will be able to:

- 05.01 Describe the different types of digital data communications systems.
- 05.02 Describe data formats and transmission rates in serial data communications systems.
- 05.03 Design the connections and programming for a UART (Universal Asynchronous/Synchronous Receiver Transmitter) in a microprocessor-based system.
- 05.04 Identify and define available options for integration of a display terminal in a data communication system.
- 05.05 Identify and define communication signals and protocol for MODEM (Modulator Demodulator) links.
- 05.06 Apply digital modulation techniques including PAM (Pulse-Amplitude Modulation), PCM (Pulse-Code Modulation), PWM (Pulse-Width Modulation) and delta modulation.
- 05.07 Analyze and design circuits for generation and detection of digital modulation.
- 05.08 Apply error detection and correction in digital communication systems.
- 05.09 Define communication protocols.
- 05.10 Design and apply multiplexing techniques for computer.

06.0 DEMONSTRATE APPROPRIATE COMMUNICATION SKILLS--The student will be able to:

- 06.01 Write logical and understandable statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
- 06.02 Read and understand graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
- 06.03 Read and follow written and oral instructions.
- 06.04 Answer and ask questions coherently and concisely.
- 06.05 Read critically by recognizing assumptions and implications and by evaluating ideas.
- 06.06 Demonstrate appropriate telephone/communication skills.

07.0 DEMONSTRATE PROFICIENCY IN RF MATH CALCULATIONS-- The student will be able to:

- 07.01 Convert between milliwatts and dBm.
- 07.02 Use power calculations to calculate change in power.
- 07.03 Explain the concepts of polarization, gain, beam width and free-space path loss.
- 07.04 Identify the basic attributes, purposes, and functions of antenna types.
- 07.05 Identify and apply the concepts that make up the functionality of spread spectrum technology.
- 07.06 Recognize concepts associated with wireless LAN service sets.

- 07.07 Calculate the Fresnel Zone radius.
- 07.08 Investigate the relationship between range and signal strength.

The following are Student Performance Standards for Wireless and IP Communications Technician for Computer Engineering Technology programs that include a specialization in Wireless and IP Communications Technician:

08.0 DEMONSTRATE PROFICIENCY IN PLANNING AND DEPLOYING WIRELESS LANS--The student will be able to:

- 08.01 Set up a wireless client.
- 08.02 Understand the concept of an SSID.
- 08.03 Understand the nature of an ad hoc wireless network.
- 08.04 Use Windows XP to manage a wireless connection.
- 08.05 Explain the purpose of the HyperTerminal program.
- 08.06 Identify the equipment necessary to connect locally to an access point for configuration via HyperTerminal.
- 08.07 Describe the basic commands used to display the access point's configuration and interface information, and to configure an IP address.
- 08.08 Identify the purpose of infrastructure devices and how to install, configure, and manage them.
- 08.09 Identify the purpose of LAN client devices and how to install, configure and manage them.
- 08.10 Identify, understand, correct, or compensate for wireless LAN implementation challenges.
- 08.11 Explain the trade-off between range and throughput.
- 08.12 Analyze direct sequence spread spectrum behavior in a co-located channel environment.
- 08.13 Examine co-channel interference using different access points.

09.0 DEMONSTRATE PROFICIENCY IN CONDUCTING SITE SURVEYING

-- The student will be able to:

- 09.1 Identify and understand the importance and process of conducting a thorough site survey.
- 09.02 Identify and understand the importance of the necessary tasks to do an RF site survey.
- 09.03 Identify the necessary equipment needed to perform a site survey.
- 09.04 Assess the performance of an ad hoc wireless network by calculating throughput.
- 09.05 Assess the performance of an infrastructure wireless network by calculating throughput.
- 09.06 Identify and discuss the design elements for creating an extended service set.
- 09.07 Differentiate between layer-two and layer-three roaming.

- 09.08 Discuss the configuration of mobile IP as it pertains to wireless communication.
- 09.09 Conduct a feasibility-study/return-on-investment study for deploying wireless solutions in a production environment.
- 09.10 Baseline the performance of the wireless network and plan for future growth.

10.0 DEMONSTRATE PROFICIENCY IN IMPLEMENTING WIRELESS LAN SECURITY - The student will be able to:

- 10.01 Identify the strengths, weaknesses, and appropriate uses of wireless LAN security techniques.
- 10.02 Describe the types of wireless attacks, and explain how to identify and prevent them.
- 10.03 Create and apply a MAC filter.
- 10.04 Configure open authentication with Wired-Equivalent Privacy.
- 10.05 Configure Service Set Identification in more secured manner.
- 10.06 Analyze the impact of spoofed MAC addresses on the security of a wireless network.
- 10.07 Create and apply IP filters.
- 10.08 Configure the Temporal Key Integrity Protocol.
- 10.09 Describe the problem of rouge access points and identify techniques of locating rouge access points.
- 10.10 Demonstrate proficiency in using wireless protocols analyzer.
- 10.11 Implement and configure WiFi Protected Access (WPA) and WPA version 2.
- 10.12 Configure Secure Shell sessions as a way to remotely manage access points and wireless bridges.
- 10.13 Implement and configure 802.1x authentication standards.
- 10.14 Implement and configure wireless encryption.

11.0 DEMONSTRATE PROFICIENCY IN CONFIGURING IP TELEPHONY SERVERS -- The student will be able to:

- 11.01 Differentiate between packet-switched voice networks and circuit-switched voice networks.
- 11.02 Explain the role of Ethernet telephony servers in call admission.
- 11.03 Install and configure telephony servers such as Cisco call manager, and Linux Trixbox.
- 11.04 Configure IP phones to successfully register with telephony servers.
- 11.05 Explain the call routing login used by telephony servers.
- 11.06 Configure individualized routing using Partitions and call search spaces.
- 11.07 Configure the basic functions of IP phones such as: call park, call forwarding, and call pickup.
- 11.08 Configure telephony servers with basic functions such as: call conferencing, meet-me extensions, and digital receptionist.

- 11.09 Explain and differentiate among the following compression algorithms: G.711, G.729, G.226, and iLBC.
- 11.10 Configure Device pools, Regions and Locations.
- 11.11 Troubleshoot IP Telephony servers by analyzing log files.
- 11.12 Troubleshoot the performance of an IP telephony network by analyzing the output of a protocol analyzer.
- 11.13 Install, configure, and register soft phones such as Cisco IP Communicator, and X-lite to register with IP telephony servers.

12.0 DEMONSTRATE PROFICIENCY IN INTERCONNECTING NETWORK DEVICES--The student will be able to:

- 12.01 Identify the equipment needed in building packet-switched voice networks.
- 12.02 Explain the role of each of the devices needed to build a packet-switched voice network.
- 12.03 Configure Ethernet switches with voice VLANs.
- 12.04 Configure switches with power-over Ethernet.
- 12.05 Configure wireless access points with voice VLANs.
- 12.06 Identify the different types of cables needed to interconnect networking devices.
- 12.07 Explain the difference between collision domains and broadcast domains.
- 12.08 Configure VLAN trunking.
- 12.09 Analyze a switch's MAC address table.
- 12.10 Analyze a router's routing table
- 12.11 Analyze an access point's association table.
- 12.12 Troubleshoot the connection between networking devices using network management applications such as Kiwi Syslog.

13.0 DEMONSTRATE PROFICIENCY IN CONFIGURING AND TROUBLESHOOTING VOICE GATEWAYS--The student will be able to:

- 13.01 Explain the role of voice gateways in packet-switched voice networks.
- 13.02 Explain the process of registering voice gateways with an IP telephony server.
- 13.03 Install and configure an H.323 voice gateway.
- 13.04 Install and configure a SIP voice gateway.
- 13.05 Install and configure an MGCP voice gateway.
- 13.06 Recognize different voice network modules and voice interfaces in voice gateways.
- 13.07 Configure a voice gateway with VoIP and POTS dial peers.
- 13.08 Configure a voice gateway with routing protocols such as RIP and EIGRP.
- 13.09 Troubleshoot the performance of a voice gateway by utilizing debug and show commands.

13.10 Explain the role of voice gateways in connecting packet-switched voice networks to circuit-switched voice networks.

14.0 DEMONSTRATE PROFICIENCY IN CONFIGURING QUALITY OF SERVICE FOR INTEGRATED SERVICES NETWORKS--The student will be able to:

14.01 Explain latency, packet loss, and jitter.

14.02 Identify sources of delay.

14.03 Identify techniques for implementing quality of service over low speed links.

14.04 Configure Differentiated services to support a VoIP call.

14.05 Configure Ethernet switches with class of service

14.06 Explain the classification, tagging and queuing of IP packets.

14.07 Implement and configure Cisco Auto quality of service.

14.08 Identify and troubleshoot quality-of-service related problems in a packet-switched voice network.

15.0 DEMONSTRATE EMPLOYABILITY SKILLS--The student will be able to:

15.01 Conduct a job search.

15.02 Secure information about a job.

15.03 Identify documents that may be required when applying for a job.

15.04 Complete a job application form correctly.

15.05 Demonstrate competence in job interview techniques.

15.06 Demonstrate knowledge of how to make appropriate decisions.

15.07 Demonstrate appropriate work/behavioral habits.

15.08 Demonstrate acceptable employee personal hygiene and health.

15.09 Demonstrate knowledge of the "Florida Right-To-Know Law" as recorded in Florida Statutes Chapter 442.