# ITT Technical Institute

# IT350

# Modern Wireless Communications

# Onsite Course

# SYLLABUS

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**Credit hours:** 4

**Contact/Instructional hours:** 50 (30 Theory Hours, 20 Lab Hours)

**Prerequisite(s) and/or Corequisite(s):**

Prerequisite: IT344 Data and Network Communications or equivalent

**Course Description:**

Wireless transmission of voice, video and data signals using radio transmission and reception methods will be studied. Modulation techniques in the presence of electrical noise and interference will be studied so as to predict appropriate performance. The areas of cellular, mobile and personal communications systems and satellite communications are included.

# Syllabus: Modern Wireless Communications

| | |
|---|---|
| Instructor: | _____ |
| Office hours: | _____ |
| Class hours: | _____ |

## Major Instructional Areas

1. Wireless networking concepts, characteristics, and protocols
2. Technologies and topologies
3. Spread spectrum
4. Antennas and propagation
5. 802.11x, cellular, and satellite

## Course Objectives

1. Establish the concepts and characteristics of wireless categories.
2. Classify the different technologies, protocols, and topologies used in wireless networks.
3. Describe different spread-spectrum signals and error detection methods used for wireless communications.
4. Analyze the principles of antennas and propagation.
5. Apply appropriate components, configurations, and security to set up a wireless LAN.
6. Analyze the concepts of cellular communication.
7. Analyze the concepts of the 802.11 protocol family.
8. Explore the security methods to use on wireless and cellular networks.

## SCANS Objectives

SCANS is an acronym for Secretary's Commission on Achieving Necessary Skills. The committee, created by the National Secretary of Labor in the early 1990s, created a list of skills and competencies that the committee feels are necessary for employees to function in a high-tech job market.

1. Choose procedures, tools, or equipment, including computers and related technologies.
2. Prevent, identify, or solve problems with equipment, including computers and other technologies.
3. Locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
4. Think creatively, make decisions, solve problems, visualize, and know how to learn and reason.
5. Exerts a high level of effort and persevere toward goal attainment.
6. Choose ethical courses of action.
7. Distinguish trends, predict impacts on system operations, diagnose deviations in systems performance, and correct malfunctions.

## Course Outline

Note: All graded activities, except the Project, are listed below in the pattern of <Unit Number>.<Assignment Number>. For example, Labs: 4.1 refers to the first lab activity in Unit 4.

| Unit | Activities |
|---|---|
| 1— Wireless Networking Concepts | • Content Covered:<br>*CCNA Wireless Official Exam Certification Guide*:<br>○ Chapter 1, "Introduction to Wireless Networking Concepts"<br>○ Chapter 2, "Standards Bodies"<br>• Labs: 1.1, 1.2 |

| Unit | Activities |
|---|---|
| | • Writing Assignments: 1.1 |
| 2—Characteristics of Wireless Networks | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 3, "WLAN RF Principles"<br>• Labs: 2.1, 2.2<br>• Writing Assignments: 2.1<br>• Project: Part 1<br>• Oral Assignments: 2.1 (For students selected by instructor) |
| 3—Technologies and Topologies | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 4, "WLAN Technologies and Topologies"<br>o Chapter 8, "Additional Wireless Technologies"<br>• Labs: 3.1, 3.2<br>• Writing Assignments: 3.1<br>• Oral Assignments: 3.1 (For students selected by instructor) |
| 4—Spread Spectrum | • Read from: *CWNA: Certified Wireless Network Administrator Official Study Guide: (EXAM PW0-100), Fourth Edition*:<br>o Introduction (What's New in the Fourth Edition)<br>o Chapter 3, "Spread Spectrum Technologies"<br>• Labs: 4.1, 4.2<br>• Writing Assignments: 4.1<br>• Project: Part 2—Equipment Cost Analysis<br>• Oral Assignments: 4.1 (For students selected by instructor) |
| 5—Antennas | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 5, "Antenna Communications"<br>• Labs: 5.1, 5.2<br>• Writing Assignments: 5.1<br>• Oral Assignments: 5.1 (For students selected by instructor) |
| 6—Protocols | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 6, "Overview of the 802.11 WLAN Protocols"<br>• Labs: 6.1, 6.2<br>• Writing Assignments: 6.1<br>• Project: Part 3—Installation and testing plan<br>• Oral Assignments: 6.1 (For students selected by instructor) |
| 7—Wi-Fi | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 19, "Maintaining Wireless Networks"<br>• Labs: 7.1, 7.2<br>• Writing Assignments: 7.1<br>• Oral Assignments: 7.1 (For students selected by instructor) |
| 8—Troubleshooting Wireless Networks | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 20, "Troubleshooting Wireless Networks"<br>• Labs: 8.1, 8.2<br>• Writing Assignments: 8.1<br>• Project: Part 4—Job costing<br>• Oral Assignments: 8.1 (For students selected by instructor) |
| 9—Security | • Read from *CCNA Wireless Official Exam Certification Guide*:<br>o Chapter 17, "Securing the Wireless Network"<br>• Labs: 9.1, 9.2<br>• Writing Assignments: 9.1<br>• Oral Assignments: 9.1 (For students selected by instructor) |
| 10—Cellular | • Read from *Advanced Cellular Network Planning and Optimisation: 2G/2.5G/3G...Evolution to 4G*:<br>o Chapter 1, "Cellular Networks," Section 1.2: First Generation Cellular Networks |

| Unit | Activities |
|---|---|
| | • Labs: 10.1<br>• Oral Assignments: 10.1 (For students selected by instructor)<br>• Project: Part 5—Presentation of project and completed writing assignment |
| 11—<br>Review and Final Exam | • Project: Part 5—Make-up for Unit 10<br>• Review<br>• Final Exam |

# Instructional Methods

The curriculum is designed to promote a variety of instructional methods that support the outcomes described in the course objectives and that foster higher cognitive skills. Delivery makes use of various media and delivery tools in the classroom.

Because the technology behind modern wireless communications is rapidly evolving, it is impossible to find a published book with the latest information about this technology. Authors and publishers simply cannot stay up to date. Consequently, within this course you will be expected to conduct your own research to learn as much as possible about the particular topics under discussion, before each class session.

At the beginning of each class session, the instructor will select one or more students to present information that they have learned about this topic. You will not know if you will be called on until you come to class. Therefore it is imperative to prepare for each class session. The presentation will be used as a segue into the lecture and labs for that session. In addition, all students will participate in small groups to complete a larger project on a relevant topic for this course.

# Instructional Materials and References

### Student Textbook Package

Carroll, Brandon James. *CCNA Wireless Official Exam Certification Guide*. Indianapolis: Cisco Press, 2009.

### References

#### ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library at http://library.itt-tech.edu/ to access online books, journals, and other reference resources selected to support ITT Tech curricula.

Books

You may click “Books” or use the Catalog function on the home page to find the following books.

ITT Tech Virtual Library> Main Menu> Books> Books 24x7

- Bartz, Robert J. *CWTS: Certified Wireless Technology Specialist Official Study Guide: Exam PW0-070*. Indianapolis: Sybex, 2009.
- Carpenter, Tom. *CWNA: Certified Wireless Network Administrator Official Study Guide: (EXAM PW0-100),* Fourth Edition. New York: McGraw-Hill/Osborne, 2008.
- Coleman, David, and David Westcott. *CWNA: Certified Wireless Network Administrator Official Study Guide:* (Exam PW0-104). Indianapolis: Sybex, 2009.

- Dean, Tamara. *CompTIA Network+ 2009 In Depth*. Boston: Cengage Learning, 2009.
- Farahani, Shahin. *ZigBee Wireless Networks and Transceivers*. Oxford, UK: Newnes, 2008.
- Hu, Honglin, Yan Zhang, and Jijun Luo. *Distributed Antenna Systems: Open Architecture for Future Wireless Communications*. Boca Raton, FL: Auerbach Publications, 2007.
- Kipper, Gregory. *Wireless Crime and Forensic Investigation*. Boca Raton, FL: Auerbach Publications, 2007.
- Mishra, Ajay R. *Advanced Cellular Network Planning and Optimisation: 2G/2.5G/3G...Evolution to 4G*. West Sussex, UK: John Wiley & Sons, 2007.
- Rao, Radha Krishna, and G. Radhamani. *WiMAX: A Wireless Technology Revolution*. Boca Raton, FL: Auerbach Publication, 2008.
- Ross, John. *The Book of Wireless: A Painless Guide to Wi-Fi and Broadband Wireless*, 2nd ed. San Francisco: No Starch Press, 2008.
- Schwartz, Mischa. *Mobile Wireless Communications*. Cambridge: Cambridge University Press, 2005.
- Shneyderman, Alex, and Alessio Casati. *Fixed Mobile Convergence: Voice over Wi-Fi, IMS, UMA/GAN, Femtocells, and Other Enablers.* New York: McGraw-Hill, 2008.
- Wang, Jiangzhou. *High-Speed Wireless Communications: Ultra-Wideband, 3G Long-Term Evolution, and 4G Mobile Systems*. Cambridge: Cambridge University Press, 2008.
- Webb, William. *Wireless Communications: The Future*. West Sussex, UK: John Wiley & Sons, 2007.
- Xiao, Shao-Qiu, Ming-Tuo Zhou, and Yan Zhang. *Millimeter Wave Technology in Wireless PAN, LAN, and MAN*. Boca Raton, FL: Auerbach Publications, 2008.
- Zhang, Yan. *WiMAX Network Planning and Optimization*. Boca Raton, FL: Auerbach Publications, 2009.


Ebrary


- Bensky, Alan. *Wireless Positioning Technologies and Applications*. Boston: Artech House, Inc., 2007.
- Byeong Gi, Lee, and Sunghyun Choi. *Broadband Wireless Access and Local Network: Mobile WiMAX and WiFi*. Boston: Artech House, Inc., 2008.
- Cache, Johnny, and Vincent Liu. *Hacking Exposed Wireless*. New York: McGraw-Hill Osborne, 2007.
- Carpenter, Tom. *CWNA: Certified Wireless Network Administrator Official Study Guide: (EXAM PW0-100),* Fourth Edition. New York: McGraw-Hill/Osborne, 2007.
- Scott, Allen W. *RF Measurements for Cellular Phones and Wireless Data Systems*. Hoboken, NJ: John Wiley & Sons, 2008.


Periodicals

You may click “Periodicals” or use the E-Journal Lookup function on the home page to find the following periodical articles.

EBSCO


- Baig, Edward C. “T-Mobile service turns cell calls into Wi-Fi.” *USA Today*, 08/02/2007.
- Griesling, John. “Evaluating 4G Performance with New MIMO OTA Test.” Evaluation Engineering, 08/2010.


**Other References**

The following resources may be found **outside** of the ITT Tech Virtual Library.

Web sites

- Developing Applications for Mobile Technology
  http://www.nysforum.org/documents/html/2006/wmg/MobileTechnology_files/textmostly/slide1.html (accessed 1/12/11)

A presentation made at the NYS Forum Webmaster's Guild providing an overview of the technologies and trends

- Wireless Forums

http://www.wirelessforums.org/ (accessed 1/12/11)
A forum for discussing Wi-Fi technology, networking, and other gadgets (portable and not)

All links to Web references are always subject to change without prior notice.

**Search by Key Terms**

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- Access point (AP)
- Ad hoc network
- Antenna
- Antenna principles
- Bluetooth
- Cell tower
- Cellular
- Code Division Multiple Access (CDMA)
- Cordless (phones, remote control, door openers)
- Direct-sequence spread-spectrum (DSSS)
- Enhance Data GSM Environment (EDGE)
- ETSI
- FCC
- Frequency-hopping spread spectrum (FHSS)
- FSSS
- Global Positioning System (GPS)
- Global System for Communication (GSM)
- IEEE
- LTE
- Orthogonal Frequency-Division Multiplexing (OFDM)
- Propagation
- Satellite
- Spread spectrum
- Time division multiple access (TDMA)
- Universal Mobile Telecommunication System (UMTS)
- Wi-Fi
- WiMAX
- Wi-Fi Protected Access (WPA)
- Wireless Application Protocol (WPA)
- Wireless Equivalent Privacy (WEP)
- Wireless local area network (WLAN)
- Wireless metropolitan-area network (WMAN)
- WPAN
- 802.1

# Course Evaluation and Grading

**Evaluation Criteria Table**

The final grades will be based on the following categories:

| CATEGORY | WEIGHT |
|---|---|
| Project | 20% |
| Oral Assignments | 10% |
| Written Assignments | 35% |
| Labs | 15% |
| Final Exam | 20% |
| **Total** | **100%** |

Note: Students are responsible for abiding by the Plagiarism Policy.

**Grade Conversion Table**

The final grades will be calculated from the percentages earned in the course, as follows:

| | | |
|---|---|---|
| A | 90–100% | 4.0 |
| B+ | 85–89% | 3.5 |
| B | 80–84% | 3.0 |
| C+ | 75–79% | 2.5 |
| C | 70–74% | 2.0 |
| D+ | 65–69% | 1.5 |
| D | 60–64% | 1.0 |
| F | <60% | 0.0 |

*(End of Syllabus)*